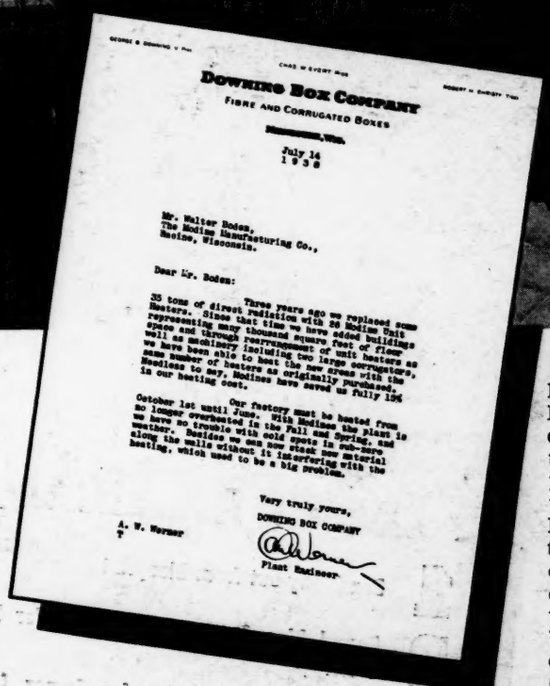
"Saved 15% in Heating Costs"



DOWNING BOX COMPANY
FIBRE AND CORRUGATED BOXES
[illegible], Wis.

July 14
1936

Mr. Walter Boden,
The Modine Manufacturing Co.,
Racine, Wisconsin.

Dear Mr. Boden:

35 tons of direct radiation with 26 Modine Unit Heaters. Since that time we have added buildings representing many thousand square feet of floor space and through rearrangement of unit heaters as well as machinery including two large corrugators, we have been able to heat the new areas with the same number of heaters as originally purchased. Modines to day, Modines have saved us fully 15% in our heating cost.

Three years ago we replaced some

Our factory must be heated from October 1st until June. With Modines the plant is no longer overheated in the Fall and Spring, and we have no trouble with cold spots in sub-zero weather. Besides we can now stack raw material along the walls without it interfering with the heating, which used to be a big problem.

Very truly yours,
DOWNING BOX COMPANY
A. W. Werner
Plant Engineer

...dern heating . . . with Modine Unit Heaters . . . ...kes *money*, whether it is installed on a modern-...tion job or new work.

The experience of Plant Engineer A. W. Werner ...st exceptional. Hundreds of Modine users . . . in ...tories, stores, offices, warehouses where direct ...ation has been replaced by Modines . . . have ...ed 15 to 25% *and more* in fuel costs alone.

Modines are attached directly to the steam or ...water line *overhead*, and are spotted, like lights, ...r maximum efficiency. The heat, that with ordi-...y radiation is wasted in overheating wall and ...ng areas, is instead *directed downward* and ...ed over the working zones and floors, exactly ...re and only where it is needed.

Individually controllable, thermostatically or ...ally, Modines deliver heat only when needed. No heat or fuel is wasted. And Modines' higher heating efficiency improves production processes, increases employee efficiency by bettering health and comfort. *Write for new free Catalog 138.*

In 1935, the plant of the Downing Box Company, Milwaukee, Wis., had direct radiation. And A. W. Werner, the plant engineer, had a heating problem on his hands. In mild weather the plant was too warm. In around-zero weather, the men in the middle of the rooms were too cold. Crowding on more steam only overheated the space near the walls without helping the cold spots. Fuel bills went steadily up . . . while the direct radiation, obviously inefficient, kept on wasting fuel. . . . So Mr. Werner replaced 35 tons of direct radiation with 26 Modine Unit Heaters. "Modines have saved us fully 15% in our heating cost," says Mr. Werner's letter, "the plant is no longer overheated in the Fall and Spring, and we have no more trouble with cold spots in sub-zero weather."

...DINE MANUFACTURING COMPANY, 1720 RACINE STREET, RACINE, WISCONSIN

&L GALVANIZED SHEETS help make shop work easier—keep jo

schedule" says this prominent fabricator

ROOFING
ASBESTOS · SLATE
TILE · COMPOSITION
WATER · DAMPROOFING

SHEET METAL AND BUILDING
HEATING & AIR CONDITIONING
VENTILATING & PIPE WORK
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STEEL CEILINGS · PARTITIONS
LOCKING SUNSHADES
FIREPROOF DOORS WINDOWS

PRODUCTS
STEEL ROOF DECKS
ASPHALT FLOOR TILE
ASBESTOS WAINSCOTING

Frank Limbach
1722 E. OHIO ST.
PITTSBURGH, PA.
CEDAR 5600

June 17, 1938

Jones & Laughlin Steel Corpn.,
Pittsburgh, Pa.

Gentlemen:

We recently used J & L Galvanized Sheets in fabricating fittings and lengths of stack for an air conditioning and ventilating job. We found these sheets soft, pliable and easy to work with in the various bending, forming and rolling operations. And because of the softness of the metal, we are able to cut the sheets cleanly.

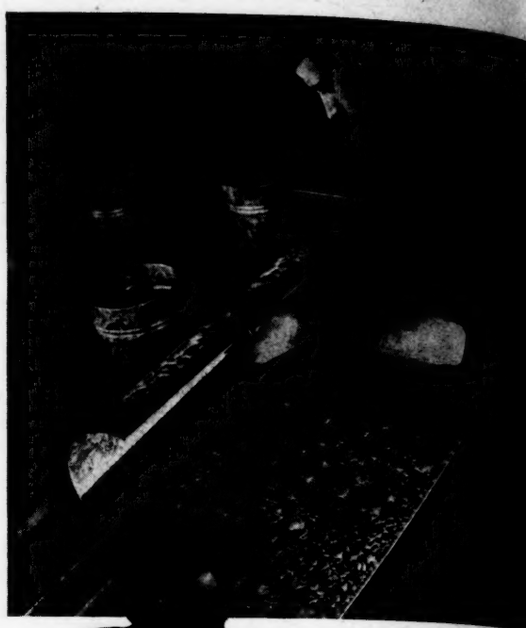
Sometimes, when you have harder, less ductile metal to cope with, the shears are forced to almost 'chew their way' through---but this did not happen in the case of the J & L material.

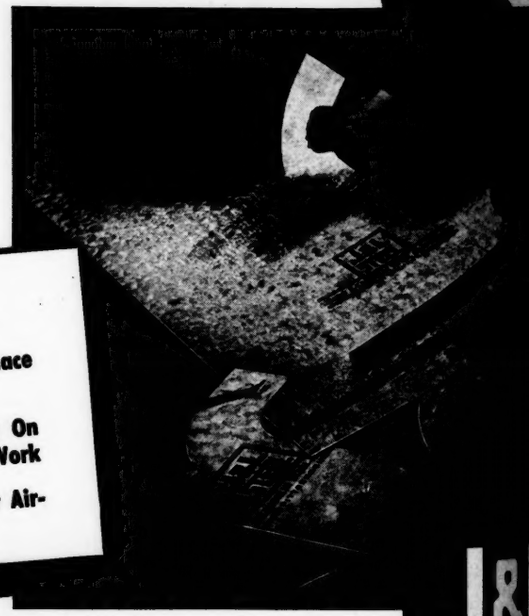
Another thing I like about J & L Galvanized Sheets is their perfect flatness. You'd be surprised how much difference there is when there are no waves or buckles to make the work tougher for you.

With J & L Sheets, we give our customers better workmanship, and jobs are always completed on schedule. It's this sort of thing that builds up our chances for repeat business---and that's important, particularly in days like these.

Respectfully yours,
FRANK LIMBACH
By Emil Limbach

EL:S





1 Bench Lay-out from Blueprint

2 Round Pipe Rolling Operation — for Furnace Work

3 Forming a Single Edge for Corner Lock On Fitting for Conditioned Air or Ventilating Work

4 Cutting Out a Y Fitting for Trunk Line for Air-Conditioning Job

JONES & LAUGHLIN STEEL CORPORATION
AMERICAN IRON AND STEEL WORKS
PITTSBURGH, PENNSYLVANIA

J&
STE

Fig. 1. In this building, larger than any previous similar structure, can be assembled airplanes three or four times the size of the largest plane hitherto built. The "Russian Clipper" shown in the foreground is dwarfed by the expanse of floor area.

Factory Building with Three-Story Door Heated without Boilers

By F. O. JORDAN†

ROOMS of conventional size with standard 3½ x 7 ft. doorways present no particularly difficult problems to the experienced heating engineer. Even the heating of large factory rooms does not usually present problems difficult of solution because ceilings generally are not too high for satisfactory heating by means of overhead unit heaters, and there usually are plenty of columns for supporting wall type unit heaters or warm air stacks as required for good temperature distribution. But problems multiply when the building covers more than a city block with an unobstructed expanse totally devoid of columns; when its ceiling is so high that there is little chance of throwing warm air down to the floor from above; and when the height and length of a single door is the height of a three-story building and the length of a city block. Even veteran heating engineers accustomed to unusual problems cannot be blamed for throwing up their hands in despair.

Nor is this a hypothetical problem presented for academic consideration. It is a true-to-life description of the assembly room in the Glen L. Martin amphibian factory recently constructed near Baltimore, Md., for the purpose of fabricating the many-ton "tin geese" that soon will fly across the Atlantic overnight.

The rapid advance in creation of airplanes of unbelievable size has resulted in unique engineering problems. Many of them are not related to the aerodynamic "teasers" that were solved by the aeronautical engineer to make flying ocean liners a success. For the enormous wing span of these amphibious giants of the water and the air requires buildings of a far different character from those that have become conventional for factory use. In order for these huge aircraft to be assembled without interference, assembly rooms of huge dimensions are required. And in order to permit the great craft to be moved about at all, the area of the assembly room must be covered by a roof thrown from wall to wall with a single span so that the entire floor space will be free from columns. Furthermore, the stature of these air liners is so great that a clear space of 45 or 50 ft. must intervene between the floor and the roof trusses. Probably the most unbelievable thing about this very unusual building now housing the Martin production line is the huge door which occupies almost an entire side of the building. Even when closed, a door that is higher than most three-story buildings and as long as a city block presents heating problems of infiltration or air change. But most any heating engineer would scratch his head for a long time if asked to figure a way of stopping every B.t.u. in the building from being "air changed" right out of existence, when a door of such proportions is opened to permit the last-born iron birdling to start its maiden voyage.

Other unique problems of the Glen L. Martin plant

†Detroit Consulting Engineer, and Mgr. of Edit. and Cons. Depts. of Refrig. & Air Cond. Inst., Chicago.

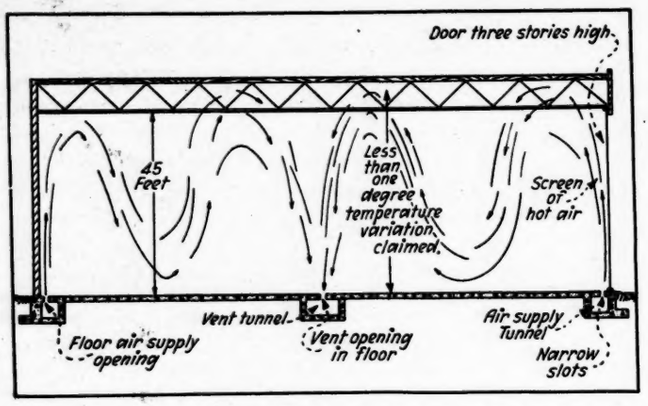


Fig. 2. Cross-section with intended path of air currents indicated.

—which included a multi-story office building of no mean proportions in addition to the "column-less" assembly building—were: the owner's decision to heat the buildings without a boiler plant, and his decision to cool the office building in summer by the same system used for winter heating.

It should be interesting for you to note at this point that the heating plant designed in the office of Albert Kahn for this strange factory building has been in use throughout an entire heating season, and that the operating engineer declares that temperature stratification is so completely eliminated that there is a variation between floor and 45-ft. ceiling of less than 1F.

Heating without boilers meant that the building must be heated by a "direct-fired" heating system, or a system heating the air by direct contact with combustion-heated surfaces, without the intermediate use of steam or hot water. This, in turn, means that the building had to be heated by a hot-blast system.

The problem of heating the factory building was solved in this way. Direct-fired gas-burning heaters were installed in small heater rooms below the floor. These heaters were provided with forced circulation fans which distribute the warm air from the underground heaters through underground tunnels extending as required for distributing the warm air about the building. Floor outlets were provided for discharging the air from these ducts upward into the building. Where it was possible to locate these outlets adjacent to wall columns, heavy steel plate baffles were located for directing the air horizontally in thin sheets above the floor. At other places where it was necessary to locate the outlets in the floor some distance from walls or columns, the air was merely discharged upward at considerable velocity. For preventing drafts at the huge door resulting from infiltration and from downward convection due to chilling of the inside air against the huge metal surfaces, long narrow slots were provided in the floor immediately underneath the door. Thus downward drafts are prevented by thin sheets of warm air directed upward at high velocity. The effect of these warm sheets of air is that even when the doors are open, screens of warm air are thrown upward across the openings.

The air is vented through floor outlets placed approximately along the center of the building and is recirculated from these outlets through an underground tunnel to the air-circulating fans.

The turbulence in the building resulting from the high velocity upward jets of warm air prevents stratification of air at various temperatures to the extent that the temperature differential between floor and ceiling is remarkably small. As previously stated, this differential has been declared to be less than 1F.

The system used for heating the office building is more conventional, as ducts are installed above the corridor ceilings, and are provided with wall-supply grilles near the ceilings of the offices through which air is supplied. These ducts and supply grilles are used for supplying warm air in the winter as required to heat the building, and cooled air in the summer time as required to keep it comfortable in hot weather.

An unusual problem of heating in the office building was that of preventing cold drafts around the large windows which constitute most of the outside wall area, since no radiators could be installed beneath them according to conventional heating practice of offices and similar spaces where the occupants are seated. The well-known difficulty of heating rooms with very large exposed glass areas where the occupants are inactive, by means of warm air discharged from outlets at the inside wall, is that cold downward-flowing convection currents are created at the windows due to chilling of the room air against the cold window surfaces. Such drafts are prevented by radiators installed under the windows in most buildings of this type. However, since no radiators were to be used in this building it was necessary to find another way. In this case the engineers found another way by placing glass baffles in front of the windows to catch the sheet of cold air falling downward across the window face, and by exhausting the air through narrow slots placed behind these baffles. The air from these slots is drawn downward through vertical vent stacks to a main recirculating duct below the first floor, through which the air is recirculated through the air-circulating fans and heaters.

The air for the office building is heated by forced circulation, direct-fired heating units similar to those used for heating the factory building, and is recirculated. Part of the air handled by the circulating fans is heated by being passed through the furnace, while a part is bypassed so that it remains at or slightly below room temperature. Mixing dampers are installed so that the

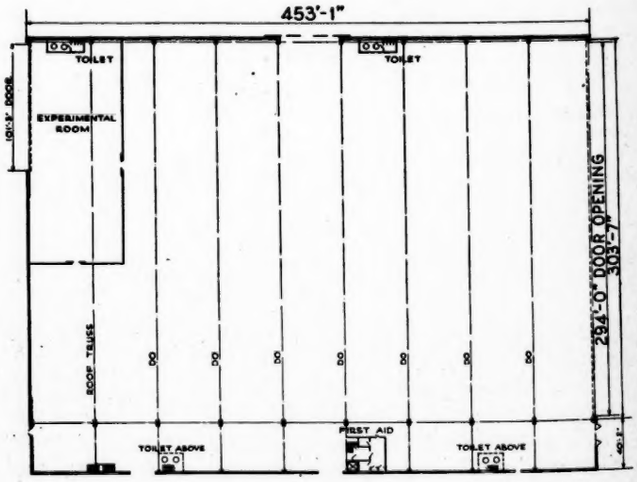


Fig. 3. Ground floor plan showing huge size of building and of door opening.

warm air and cool air are mixed as required for proper regulation of the temperature in the various zones into which the building is divided.

Each story is divided into four zones, and a separate supply duct carrying mixed air is extended to each zone. The setting of the mixing dampers to each of these supply ducts is controlled by a room thermostat in the zone so that the temperature of the air supplied to the zone is properly regulated for maintaining the desired zone temperature. Zoning is made necessary because the building may be exposed to cold winds from various directions so that load variations in the differentent zones are not the same.

The same air-circulation fans and distribution system of ducts and supply grilles is used both for heating and for cooling the building as mentioned above. The air upon being recirculated from the building in the summer time is drawn through filters, direct expansion cooling and dehumidifying coils, and through moisture eliminating plates in the order named. This air is bypassed around the heater and is supplied directly to the main ducts to the various zones. Zone control is not required in the summer time because the long dimension of the building extends eastward and westward so that the sun load cannot shift from one long side of the building to the other, but strikes only the long southern exposure.

Outside air intakes are of sufficient size to permit the entire air-circulating capacity of the supply fans to be drawn from outside the building so that air conditioning can be accomplished without the use of the cooling equipment when the outside air conditions are satisfactory in spring and fall weather.

The office air conditioning system has been in use for an entire winter season and an entire summer season. During this time the operation is declared to have been very satisfactory as close control of temperatures and humidities within the comfort zone have been maintained at all times.

It is interesting to note that satisfactory humidities have been maintained during the summer even without installation of bypasses or any other type of humidity control because of the ability of properly selected refrigerating equipment operating at correct refrigerant temperatures to maintain the balance between sensible and latent work of the equipment required to maintain temperatures and humidities within the comfort zone when used with buildings and occupancies of this type.

Design Factors

Conventional design factors were used in estimating the winter heat loss and the summer heat gain in this building and in designing the summer and winter air conditioning equipment and air distribution systems. The overall transmission factors used for the various building materials, and the air change factors used in the various rooms are the conventional factors used for buildings and materials of the type employed in this installation.

The velocities at which air is supplied into the offices and cafeteria have been selected according to the recommendations of the air supply grille manufacturers, due consideration being taken of the differential between entering air temperature and room temperature, of the horizontal distance through which the air is to be thrown in each case, and of the vertical distance through which the air can be allowed to fall during its trajectory across the rooms without reaching a low level at which it can strike the occupants. In other words, entrant velocities have been selected so that the air is carried completely across the area to be conditioned by it and so that the velocity just dies out at the wall opposite the grille, allowing the air to mix with the room air and settle down over the entire floor area. By this arrangement, very satisfactory temperature distribution is obtained.

The velocity of the air entering the factory building through the floor outlets is maintained between 1500 and 2000 f.p.m., as fairly high velocities were necessary to create the necessary air turbulence to prevent temperature stratification.

Shows How Problems Can be Solved

The results of this installation are particularly interesting because of the many unique problems requiring solution in designing it. For example, the problem of heating the buildings without the use of hot water or steam boilers was solved by the use of gas burning, forced-air circulation, direct-fired heaters; the problem of preventing cold down-drafts at the large windows in the offices, even without installing radiators under them, was solved by drawing away the cold air falling across the face of the windows through narrow vent slots located behind glass baffles; the problem of obtaining even temperature distribution throughout a large factory building with high ceilings and clear spans of great area was solved by discharging warm air upward from the floor near the walls at very high velocities, and venting it through floor openings near the center of the building; and last, perhaps most difficult of all, cold drafts were prevented in the vicinity of the huge door while it is closed and greatly minimized while it is open by discharging a screen of hot air at high velocity upward in front of the door through long narrow supply openings in the floor.

To the engineering profession this installation and its satisfactory results obtained under very difficult and unusual conditions indicate how much can be accomplished by experienced engineers.

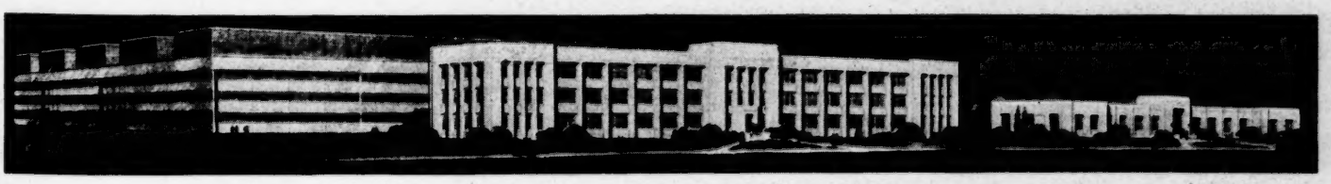
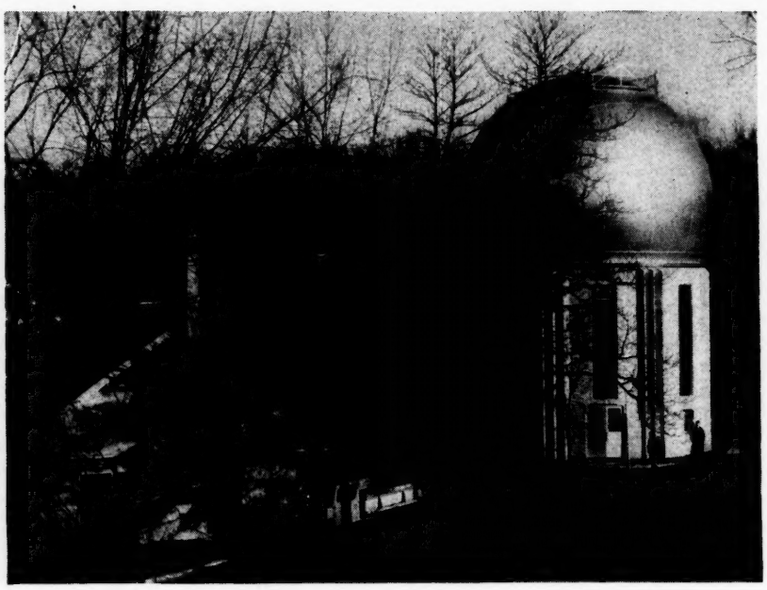


Fig. 4. Main assembly building is in the background with the new engineering building in the foreground. At the right is the existing office building.



Atomic Physics Observatory, Department of Terrestrial Magnetism, of the Carnegie Institution of Washington.

Air Conditioning Helps Smash the Atom

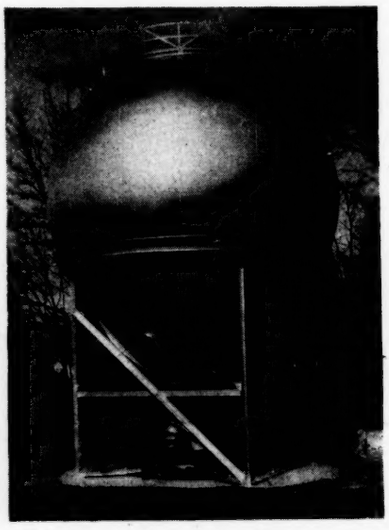
PROVIDING the proper conditions for apparatus used for smashing the atom is the latest application of air conditioning. The Department of Terrestrial Magnetism of the Carnegie Institution of Washington has recently completed an Atomic Physics Observatory which will be used to further its detailed studies of the forces within the atom. The principal part of this observatory is the electrical equipment, which is capable of producing a potential of over 5 million volts. To insulate the equipment carrying this extremely destructive voltage, dry air compressed to 50 lb. per sq. in. is used. The compressed air must have a relative humidity of 20% or less to maintain a sufficient degree of insulation in the electrical structure to hold 5 million volts. To provide this dry air is the purpose of the conditioning unit which was installed in the Observatory.

Surrounding the electrical equipment is a large steel tank 55 ft. high. In appearance the tank looks like a very pointed egg of some monstrous bird, the pointed end resting on the ground. The hemisphere which makes up the top of the tank is exposed to the weather, while the pointed end is enclosed by a circular brick building with tall, glass brick windows. The target room where the atom smashing experiments are made is underground beneath the tank. To help shield the men conducting the experiments against the intense neutron-rays and gamma rays produced at the target, they stand in a tunnel around the corner from the target room.

The high voltage generator is an electrostatic machine, with the electric charge conveyed by a belt from the base of the tank to the high voltage electrode. The belt, made of rubber and fabric, acts as a "bucket hoist" for the electric charges, which are sprayed onto it near the base of the tank by points charged to 30,000 volts using a transformer and rectifier tube. The belt conveys the electric charge to similar points inside the high voltage electrode. This electrode is a 5-ton steel ball, 19 ft. in diameter, supported 26 ft. above the base platform on fireproof insulating columns. The direct current voltage on this electrode can be maintained constant to within 1% or less at any desired value from ½ to 5 million volts.

Inside the high voltage ball are a.c. and d.c. generators (110 volts) driven by another belt extending from a motor in the base of the steel tank. These generators maintain a glow discharge or arc in a hydrogen or helium vessel at the top of a high-vacuum tube, which extends from the ball downward through the bottom of the tank to the target room beneath. Hydrogen, heavy hydrogen or helium particles, as desired, are produced by this discharge and are then accelerated down the vacuum tube by the high voltage, striking the targets with velocities as great as 1/10 the velocity of light and producing atomic transmutations. Since here atoms of one chemical element are actually transformed into atoms of another element, this is an actual realization of the dream of the medieval alchemists, although on a very small scale.

The tube may also be used with



Fifty-five foot steel tank which was built to house the electrical equipment for research on the atom. Air conditioning equipment is used to dry the air in this tank.

electrons instead of hydrogen particles, thus producing 5 million volt X-rays.

The volume of the tank is 36,000 cu. ft. and when open to the atmosphere the air within weighs about 1 1/3 tons. Approximately 120,000 cu. ft. of free air is added to bring the pressure up to 50 lb. sq. in. The weight of the air in the tank is then about 5½ tons.

It is very important that this air be maintained with a relative humidity of 20% or less at all times when the unit is operating. If the relative humidity is allowed to get much higher than this the rubber and fabric belts are violently ripped by the artificial lightning bolts which pass down them if they become slightly conducting because of the absorption of water.

A special dehumidifying unit of the activated alumina type is employed to dry the air. This unit is so connected to the tank that it first dries the air already in the tank, by recirculation, to below 10% R.H. and then dries the air going to the air compressor.

The activated alumina unit will discharge approximately 2500 c.f.m. at 3% R.H. About 20 hours are required to lower the moisture content of the tank to well under 10% R.H. This time would be reduced if it were possible to allow distribution piping within the tank, instead of having both the intake and the exhaust from the drier near together at the bottom of the tank. The presence of such ducts would cause sparks at a lower voltage and therefore they had to be omitted.

The moisture content of the air to the compressor is much below 3% R.H. since the capacity of the unit is 2500 c.f.m., while the capacity of the compressor is only 130 c.f.m. The excess air is recirculated within the activated alumina unit so that it is dried more than if it had just passed through the unit once. Although, obviously, all of the water in the compressed air is added to that which is left in the tank after recirculation, the final humidity remains below 15% at 50-lb. gage unless a great drop occurs in the outside temperature.

Since the top of the tank is exposed to the outside air it is necessary to make some provision for regulating the temperature in the tank. The top has been painted with aluminum paint and is sprayed with water during the summer to reduce the solar heat gain. Measurements have shown that on the hottest day last summer the temperature in the tank did not exceed 95F.

It is necessary to prevent the temperature from falling too low in the winter, because of the possibility of breaking the wax seals on the high vacuum tube. Four wall type steam radiators were therefore placed in the bottom of the tank.

It is worth noting that the electrical conductivity of the air and the belts appear to depend upon the relative and not the absolute humidity. This means that when the tank is maintained under pressure for long periods, relative humidity changes will occur inside because of the temperature changes. Later when the unit is operated for long periods it will be necessary to add a trickle drier which can withstand 50-lb. pressure to bring back down the increased relative humidity caused by change from warm to cold weather.

HOW THE ATOM IS SMASHED

It is the primary purpose of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington to study the magnetism of the earth and their observations and field work are world-wide in extent. In a laboratory attempt to learn as much as possible about the fundamental nature of magnetism itself, the Atomic Physics Observatory has been constructed, as an outgrowth of high voltage experiments carried on at the Department during the past 12 years.

All substances are made up of atoms which are in turn made up of electrons and charged cores or nuclei. To modern scientists these nuclei present a real puzzle. The nucleus of an atom of ordinary lead, for example, carries 82 positive charges and with its 82 outer electrons, the atom as a whole is electrically neutral. But according to the electrical law of attraction and repulsion "like" charges should repel each other. This would apparently require the lead nucleus with its 82 positive charges to fly apart with explosive violence, unless the electrical law "like charges repel" is untrue in the inner region of the atom.

Because the primary "building blocks" of matter which carry these charges have magnetic properties it is necessary that their behavior in simple relation to each other as single particles be better understood before there can be any basic understanding of the complex phenomena of large scale magnetism.

Recognizing this, the Department of Terrestrial Magnetism in 1926 began a program of research with high-energy atomic particles produced by means of high voltages. In the course of this work, large non-electrical forces have been found deep inside the atom. The experiments have shown that if a positively charged particle approaches another positively charged particle with a very high velocity it is possible to overcome the large repulsive force which "like charges" exert at ordinary atomic distances of approach. When this electrical force is overcome by the momentum and the two particles are brought exceedingly close to each other (one millionmillionth of an inch) an attraction abruptly sets in and the two particles sometimes stick together to form an atom of a heavier element. For example, if carbon atoms are bombarded with high speed hydrogen nuclei, the hydrogen is captured and nitrogen atoms are produced. This attractive force between the component parts of atomic nuclei has been measured directly in grams or ounces by the experiments in the Department's laboratory using a 1,200,000-volt generator installed in 1934. The new equipment designed for use at steady potentials as high as 5 million volts, now installed in the Atomic Physics Observatory, will permit a more detailed study of sub-atomic forces and of other properties of the primary particles which form the basis of all material things.

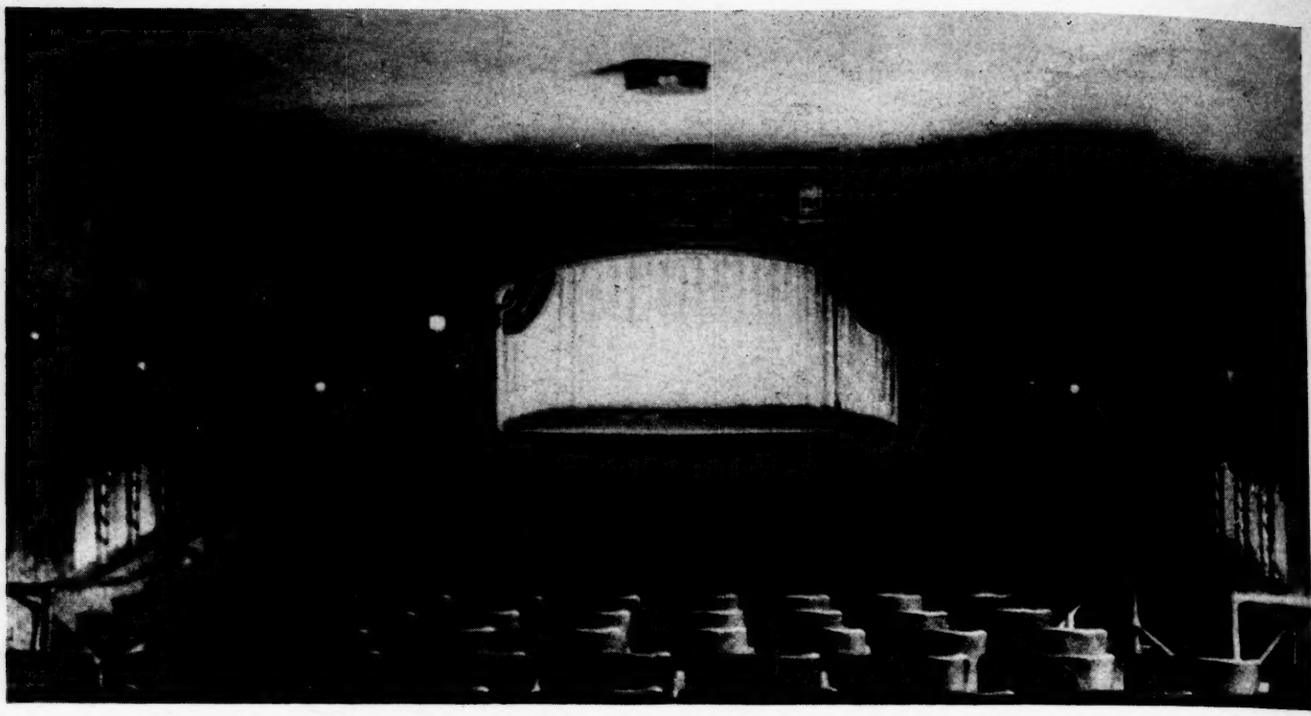


Fig. 1. Valencia Theater at Macon, Mo., which was cooled at a cost of $5.62 a seat.

Storage Refrigeration Cuts Theater Cooling Costs 66%

By CARL F. BOESTER†

Buildings which have a short daily occupancy are relatively expensive to cool when conventional air conditioning equipment is used. To reduce the high original cost new types of systems have come into use. One of the most successful of these is the storage refrigeration system. This system involves the use of a small condensing unit operating over a long period, up to 24 hours a day, to accumulate ice in a storage tank. During periods of occupancy the refrigeration stored in the tank is drawn upon to meet the cooling needs of the system. In this article the principles of such a system and a typical application are described. The author is especially well qualified to write such an article since he has installed a large number of these systems in the middle west.

WHAT the average theater owner needs is a method of summer cooling that will give the comfort of a full capacity, direct expansion refrigerating system at a first cost and an operating cost that the owner can afford. The application of storage refrigeration can attain these ends and offer real results in the way of personal comfort to theater patrons.

The principle of storage refrigeration involves the use of an accumulator, which is nothing more than an insulated tank filled with water in which are placed refrigerating coils, to which is connected a compressor so sized as to operate any desired period up to 24 hr. a day. The whole equipment is so planned that during the hours when the theater is out of use refrigeration in the form of ice accumulates on the coils in the tank. In this manner enough refrigeration is produced and stored up in a 24-hr. period to be used in the 4-, 6-, or 10-hr. operating period of the average theater. The smallest compressor, smallest electric motor and smallest allied equipment result when the design calls for full 24-hr. operation. This produces lowest first cost and the small electric motor driving the compressor means a favorable operating load at a high power factor.

The main feature of the ice storage system as used by the author is a series of special evaporator sections in the accumulator tank. The evaporator sections are so constructed that when the ice is formed it appears as solid blocks immersed side by side in the tank of water. Above these special evaporators is a system of piping with holes drilled in it so as to allow the water to flow over the ice blocks and become cooled.

The evaporator sections are operated dry with an individual expansion valve for each evaporator. It has not been found to be practical to operate the coils flooded because of the large amount of refrigerant required which would nullify the low cost advantages of the storage system. Since ice is lighter than water it is necessary to anchor the sections to the

†Air Conditioning Engineer, St. Louis, Mo.

bottom to prevent them from moving when covered with ice.

It is important that the evaporators be made large enough so that the ice is not completely melted off even under the worst conditions. If this occurred the increased temperature of the water would tend to overload the compressor.

The actual design of the evaporator is governed to some extent by the cost of power. Where it is high, increasing the evaporator surface and changing the design slightly will keep the consumption down. First cost is increased but not in proportion to the power savings. It is also necessary to eliminate as far as possible by skillful design, the penalty imposed by layers of ice which build up on the sections, acting like insulation and cutting down the capacity of the refrigerating equipment. To offset this penalty somewhat is the fact that the efficiency of refrigeration for storage is higher because of constant operation at practically full load.

To illustrate the application engineering involved in applying the storage principle to a typical theater installation, and to show the saving involved, an installation will be described of a summer cooling system at the Valencia Theater in Macon, Mo. This is a typical small town theater of the stadium type, seating 640 people. The cost of this summer cooling system employing the storage principle was $5.62 per seat—a total cost of $3,600 as compared with a cost of $16.96 per seat for the usual installation not using the storage principle, which figure was given in a recent article of a theater trade publication as an average installation cost.

In all fairness, it should be stated that the fan was a used fan already in the possession of the theater owner, but in arriving at the average installation cost of $16.96 about which we first spoke, several of the estimates used in striking an average also included used fans. In the particular installation here described, the fan was the only piece of used equipment employed.

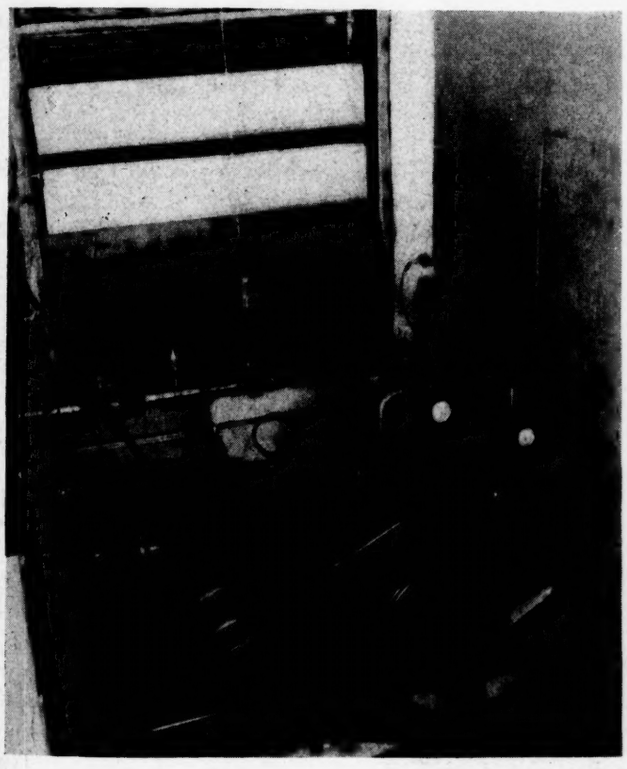


Fig. 2. A 15-hp. motor drives the refrigerating compressor and the fan and pump on the evaporative condenser. Air washer in background has a special multiple-surface stuffing over which water is flowed counter to the air flow.

All Outside Air Used

To achieve this low cost called for real skill in application engineering. In order to eliminate the cost of a return air system, it was decided that all outside air would be used. Under design outside air conditions of 95F dry bulb and 78F wet bulb, it was decided to handle 6500 c.f.m. of outside air through the cooling system and cool this down to between 45 and 50F saturated.

This air is introduced into the theater through an insulated galvanized iron duct, 24 in. x 30 in. in size, run through the attic space in the theater and discharging the air into the theater through two circular ceiling outlets. The air is introduced at considerably below the dewpoint temperature of the air in the auditorium. In order to prevent condensation around the outlets, the air is brought in at a very high velocity and any condensation occurring is carried by the high velocity air and dissipated by evaporation before reaching the occupancy level. The high velocity of the supply air permits a thorough mixing of the supply and room air, thereby providing a desirable temperature at the occupancy level. The ceiling height of the theater is such that this can be done without any noticeable air movement at the occupancy level.

The temperature in the auditorium is controlled by varying the quantity of air introduced into the conditioned space. A damper in the fan discharge accomplishes this, and this damper is controlled by a positioning-type damper motor, in turn controlled by a thermostat according to the temperature desired to be maintained, or according to the load in the auditorium.

Unusual Air Washer

An air washer of novel design was used as the means of cooling the air. In the first place, the air washer had to be located back stage so that it was imperative that noise be reduced to a minimum. Any splashing noise, such as that of sprays from nozzles against the metal housing of the washer, would have been objectionable. Furthermore, the efficiency of spray type washers is not as great as might be desired in cooling and dehumidifying outside air. Therefore, an air washer was designed with a special multiple-surface stuffing over which water is flowed counter to the air flow. Tests on this new type air washer have proved that the air leaves the washer at a temperature approximately that of the leaving water temperature. By flooding water over this multiple surface stuffing, the size of the pump needed was materially reduced, and of course the pumping head was reduced by the elimination of spray nozzles. This contributes to a low operating cost.

The air washer is constructed over the storage unit tank so that the water drains down into this tank. The housing of the washer is thoroughly insulated. Inci-

dentally, this new type stuffing in the washer is considerably less costly than conventional nozzles and piping for such nozzles, and also much lighter in weight.

Storage Unit

The storage unit in this application consists of a tank made of concrete having 6-in. walls and bottom. This tank is placed in the ground, the top being level with the stage floor. Over the top of this tank is placed the housing of the air washer and fan. Inside the storage tank is placed an evaporator coil made in four sections, each section being approximately 8 ft. long, 5 ft. high, and 15 in. wide. The evaporator sections are constructed of ⅝-in. copper tubing. Ice is frozen on these evaporator sections by filling the tank full of water, thereby submerging these sections. When the freezing cycle is completed, it looks as though there were four blocks of ice in the tank, having the above mentioned dimensions. By a specially designed piping arrangement, the flow of the water from the air washer is such that it passes over the surface of these blocks of ice, thereby becoming chilled; it is then recirculated back to the air washer by a pump powered by a 1½-hp. motor and handling approximately 120 gal. of water per minute.

Dichlorodifluoromethane is the refrigerant used in the evaporator and it is fed to the evaporator sections by thermostatic expansion valves. The evaporator is thus operated dry in order to keep the cost of the refrigerant at a minimum. On each evaporator section there is installed a heat exchanger.

Control of the accumulation of ice on the evaporator sections is made possible by placing the bulb of bulb-type thermostats near the evaporator sections in the tank. When the ice is accumulated to the thickness desired, the thermostats automatically stop the high side equipment. These thermostats are wired in series with the high pressure cutout on the compressor, which in turn is wired to the magnetic starter of the compressor motor.

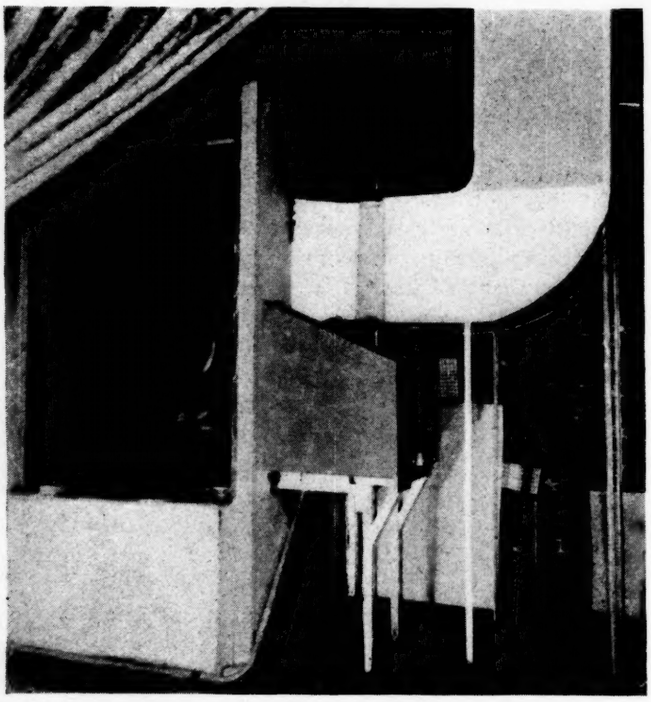


Fig. 3. Fan and upper part of ice accumulating tank. The section of tank projecting above the stage is heavily insulated.

A four-cylinder 4¼-in. x 3-in. compressor is operated at a speed of approximately 500 r.p.m. to produce 8 tons of refrigeration at a 20F temperature. An 8-ton evaporative condenser equipped with a receiver to hold approximately 150 lb. of refrigerant is used. A 15-hp. motor drives this compressor, the fan and the pump of the evaporative condenser also being belted to the compressor motor, thereby eliminating fan or pump motor failures on the condenser, and also eliminating the cost of such motors, the cost of wiring them up and the cost of controls for them. When the compressor starts the condenser has to function. An oil trap is used beween the compressor and the evaporative condenser to return any free oil in the discharge gas to the crankcase of the compressor. The system is equipped with the usual pressure relief valve, safety devices and stop valves.

Evaporator Details

Eight tons of ice can be accumulated in the storage unit. This provides sufficient refrigeration for the cooling system to be operated and maintain the desired temperature (80F dry bulb with a 50% relative humidity) during the theater's 6-hr. operating period. Approximately 100 sq. ft. of surface are used in the evaporator coils per ton of ice accumulated. The evaporator coils cost about $100 per ton of ice accumulating capacity, including expansion valves and heat exchangers. In different applications the amount of surface on the evaporator coils per ton of ice to be accumulated will vary according to the power costs of the locality; also, the centers on which the tubing is placed in making up the evaporator sections in order to control the thickness to which ice is accumulated on these sections. Of course, the thicker the ice accumulates on the tubing, the greater the power bill becomes. A ton of ice can be accumulated on the average evaporator, of which the one described here is an example, with an electric consumption of approximately 30 kw-hr.

The number of passes and the length of the passes in each evaporator section are calculated to maintain desirable refrigerant velocities and to eliminate high pressure drops through the coils. Since in the average storage installation the compressor runs approximately 20 to 22 hours per day, and the condensing temperatures are lower during night operation than during day operation, the power penalties due to lower suction pressure are partially offset.

When comparing storage refrigeration operating costs with direct expansion operating costs, the latter type system, because of frequent cycling and partial load inefficiencies, produces a ton of refrigeration with an average electric consumption of 24 kw-hr. By employing storage refrigeration, which permits the use of a much smaller electric motor and connected load, we eliminate demand charges, and the operating cost for the storage system becomes no greater, and in some instances is less than that for a direct expansion system.

The capacity of this cooling system measured in rate of consumption is 40 tons. The dollar and cents advantage to the owner of a storage application is striking.

Modernized Hot Water Supply Makes Large Saving in Apartment Group

By D. D. ZINK†

MODERNIZATION of a domestic hot water supply system in seven apartment buildings at a cost of $1,720 saves $500 per annum in operating costs and gives much better and more dependable results. That is the record of an installation made in 1935 to reduce operating costs of a group of buildings operated by Norton Adler and associates in Kansas City, Mo. The buildings are located on the site as indicated in Fig. 1.

The new system consists essentially of a large indirect heater supplied with steam by the stoker-fired heating boiler in the center building; a circulating system which distributes the water to all buildings through the original storage tanks; and a suitable control system for pumps and stoker.

Old System

Before modernization each building had the usual side arm heater and storage tank arrangement, gas being controlled by immersion thermostats. The gas heaters were supplemented by indirect water heaters.

The tanks were not installed high enough to give good circulating head, and the indirect heaters were installed too high, resulting in sluggish water circulation and lack of cleanout facilities which had stopped up the water coils in the heaters and made them inoperative. Existing connections also allowed the short circuiting of hot water.

†Consulting Mechanical Engineer, Kansas City, Mo.

The cost of operating the heaters averaged approximately $1,000 per annum.

New Installation

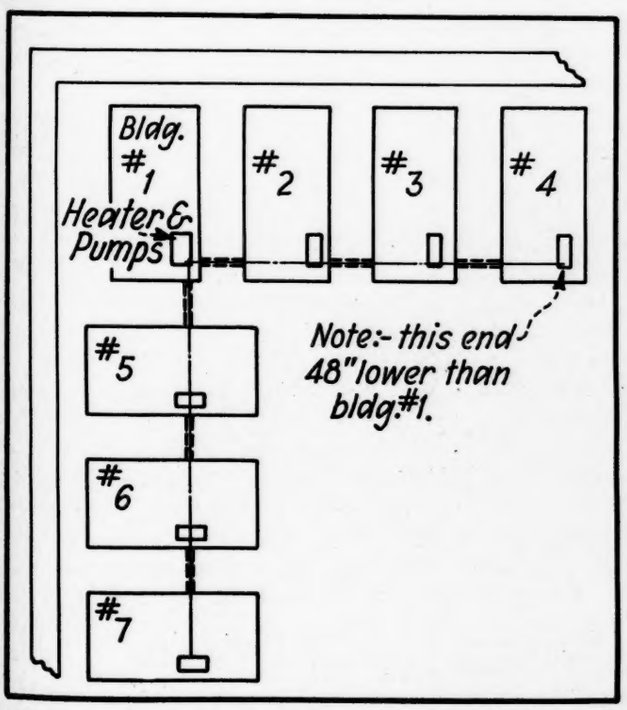
The buildings having been recently insulated, ample boiler capacity for heating both building and domestic hot water was available in center building (see Fig. 1). A stoker was installed for automatic operation the year around. A stoker providing accurate combustion control on low fires and a dependable hold fire cycling device was chosen. Low water and high pressure safety cutout were provided.

Valves were included to isolate the building heating system during the summer months. A 30-in. deep canopy of rock board was erected over the boiler and heater, and the space between floor joists over boiler was blown full (12 in.) of rock wool to prevent heat entering the apartment above. A 16-in. ventilating fan exhausts the heated air from this canopy. This fan is manually operated but could be operated by a thermostat located in the canopy. All boiler and piping insulation was repaired and put into first-class condition.

A large instantaneous shell and tube type heat interchanger was installed adjacent to the heating boiler near the ceiling. The heater was thoroughly insulated with 2 in. magnesia block. Nominal capacity of the heater is 600 gal. at 40F rise per hour.

Water is circulated from the buildings through this heater, and back through the storage tank of each building by a small direct connected motor driven by a centrifugal type pump. Pump capacity is 10 g.p.m. at 40 ft. head. A complete pumping unit is provided for standby, also a manual bypass is installed, and by test this bypass gives fair results. This is due to forced circulation provided by the entrance and direction of cold water described below.

Two-inch circulating supply lines and 1½-in. return lines make two circuits, one for each group of three buildings. These lines are insulated with 1-in. magnesia covering and are run between buildings through conduit. Twelve inches oil well casing, coated inside and out with asphaltum and buried with its top 36 in. below the surface of the ground, extends through the



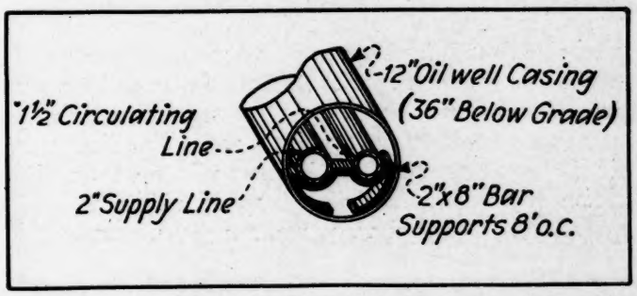


Fig. 1. (Left) Plot plan showing arrangement of seven buildings on the land. Fig. 2. (Right) Detail of conduit used for carrying water pipes underground between buildings.

foundation walls of adjacent buildings, and provides a water tight conduit, with air circulation around piping (see Fig. 2). A ⅜-in. by 2-in. steel bar was bent as shown in Fig. 2 to provide supports for the pipe. Conduit is graded to drain.

Bronze stop cocks (S, Fig. 3a) were provided to balance circulation in the two circuits by equalizing friction. The relief valve was installed in the return line in order to prevent excessively high temperatures from affecting the mechanism of valve. Hot water from the heater is circulated through each tank, the tank acting also as a storage unit. The hot water is pumped in at the top of the tank at one end and out of the bottom of the tank at the other end in order to assure filling of tanks with hot water instead of short circuiting. Makeup water is provided by connecting to cold water supply line in each building. Using these existing supplies saved the expense of a new large service.

Check valves were installed in the 1½-in. circulating line so that all cold water entering the system would have to flow toward the heater. This gives a natural forced circulation and prevents cold water entering hot water lines leading to points of usage.

Aquastats were installed in flow lines ahead of the heater to control the pump and the stoker (see Fig. 3a). Aquastat number one is set several degrees below number two and starts circulating pump only; number two controls stoker only.

The existing storage tanks were raised and reconnected as shown in Figs. 3b and 3c. The indirect heaters were reconnected into the boilers by cutting holes just below water line and welding pipe couplings of the full size of heater tapping into the boiler shell. Heaters were then thoroughly cleaned and reconnected, both supply and return with full size pipe, carefully reamed and run as directly as possible. Every precaution was taken to maintain maximum head and minimum friction, in both primary and secondary heater circuits.

Clear-away three-way flushing valves were installed in both circuits of each heater. The janitor now flushes each circuit twice a week. During the heating season, these heaters now do a good job of supplementing the central system.

The summer operation of the system is as follows (refer to Fig. 3a): When a tenant opens a hot water faucet, cold water rushes in to replace the loss. This water enters the return circuit and, being prevented by check valves from going back toward the hot storage tanks, moves toward circulating pumps. When sufficient cold water enters the return to affect aquastat number one, the pump is started and the water temperatures of the entire system are equalized. Two stop valves (S) are utilized to equalize friction on the two circuits and assure uniform circulation. Due to difference in elevations, one circuit has to deliver hot water against gravity action. If the water after equalization is colder than the setting of aquastat number two, the stoker is started by that instrument and runs until the aquastat is satisfied at 135F (unless interrupted by the high pressure safety limit control or low water cutout). The valves at S2 and S3 are closed during the summer season to prevent warming of radiators. Hold fire controls on the stoker cycle it at predetermined intervals, sufficient to maintain a kindling fire at all times. A manual snap switch was provided to shortcut aquastat and maintain constant pressure on the boiler during peak times for quicker response; however, this has never been needed, response being almost instantaneous. After aquastat number two stops the stoker, and the differential setting on aquastat number one is reached (several degrees below the off setting of aquastat number two) the pump is stopped and the hot water stored in the tank in each building is used as standby until the addition of cold water again starts pump and stoker.

During the heating season a thermostat in a third floor apartment controls the stoker according to room temperature. The heating boiler is adequate to handle the heating of the building as well as most of the domestic water required for all buildings. However, valve S2 is throttled, and the indirect heaters on the various boilers are utilized in below waterline operation, whenever there is fire in any boiler, thus supplementing the large heater. During three years of operation, little adjustment has been required on the part of the attendant and excellent and dependable results have been obtained.

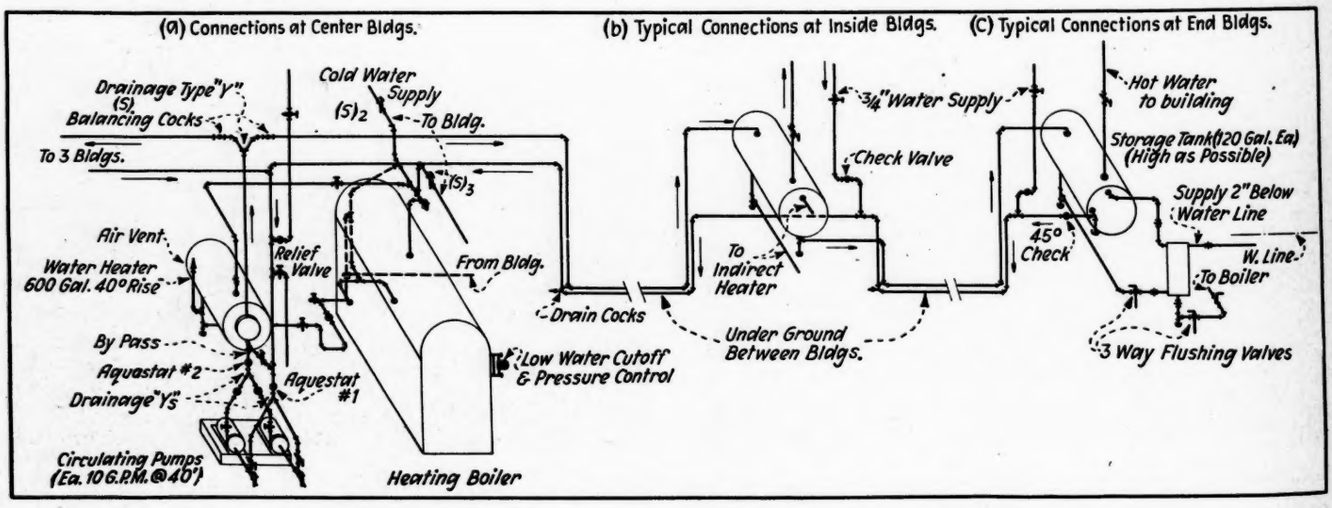


Fig. 3. Arrangement of equipment and piping for hot water supply system.

A line of 3-tier spinning machines in Industrial Rayon's new plant. Inside this glass and steel tier liquid rayon passes through minute holes in nozzles submerged in the "spin bath" and comes out as yarn. It is processed as it passes over a sequence of reels in the lower sections to bobbins at the bottom, beneath the second tier walkway seen on the left.

New Windowless Rayon Plant Air Conditioned

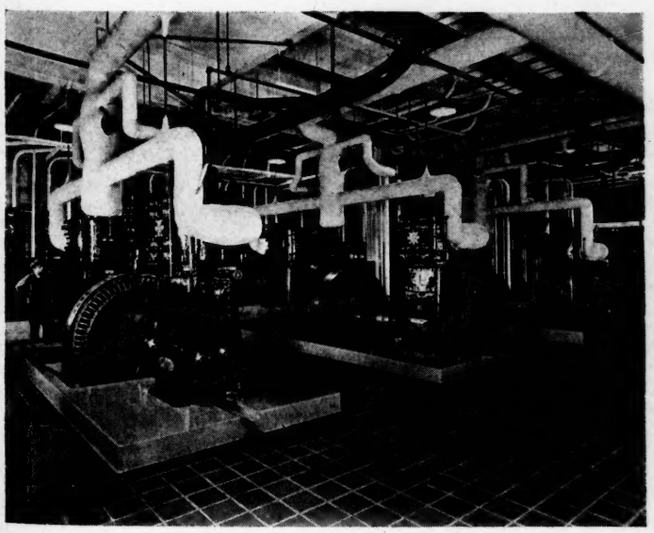
THE Industrial Rayon Corporation's new windowless, air conditioned $11,500,000 plant at Painesville, Ohio, built to accommodate production of custom-built rayon yarns by a new continuous spinning process, sets new records in many aspects of industrial construction. More than 371,000 glass blocks have been used in this 14-acre structure which represents the largest structural glass installation on record. The plant is of functional design and incorporates the most up-to-date production and processing controls.

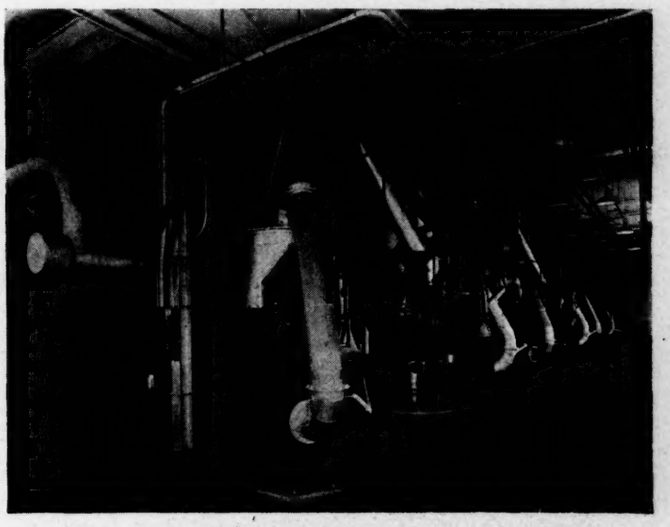
Three boilers generating 270,000 lb. of steam per hour feed three turbo-generators generating 15,000 kw. per hr. The cooling system has a capacity of 1800 tons of mechanical refrigeration, 1500 tons of which is used in the air conditioning system.

Fifteen million gallons of water required daily are pumped from a well 700 ft. inland, which is fed by gravity from a 48-in. water pipe.

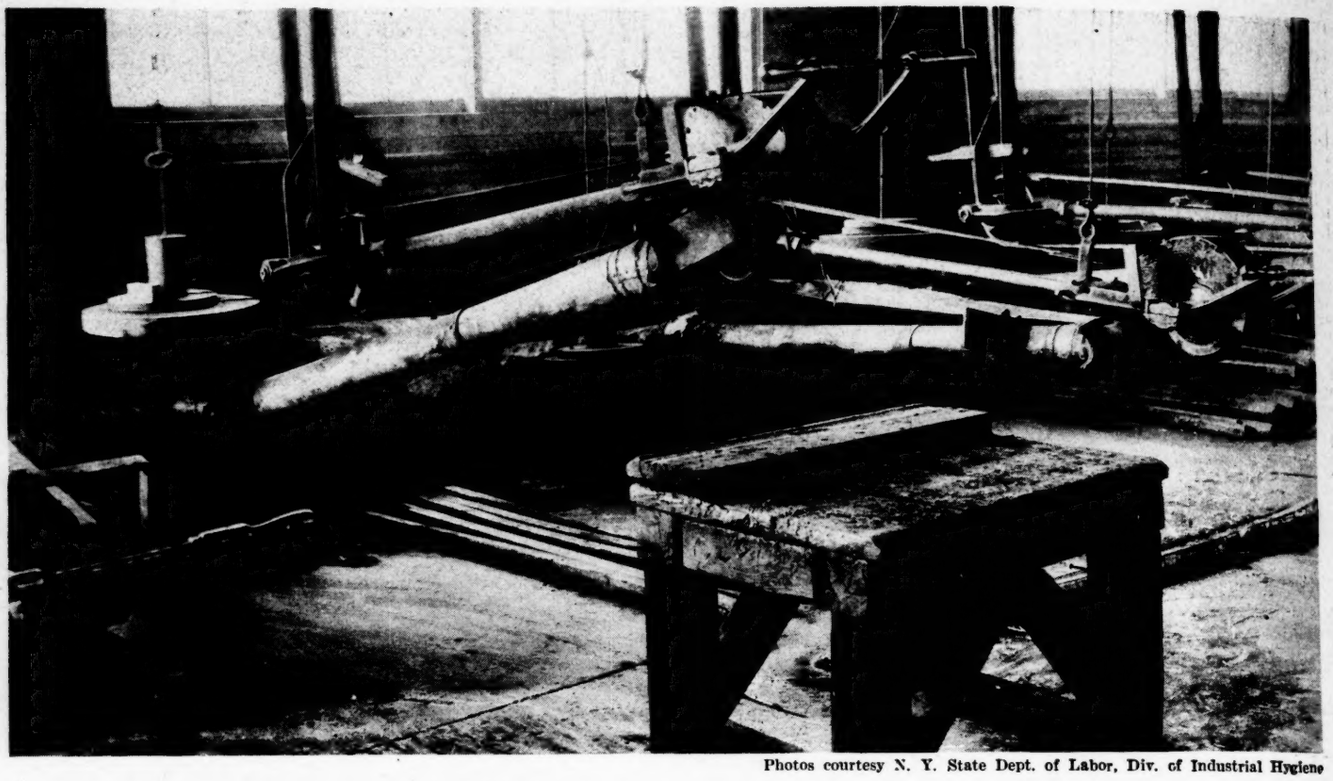
The materials handling and routing has been designed to take maximum advantage of gravity flow throughout all stages of the operations. Incoming materials are received over an elevated trestle connecting with spurs which are served by three railroads. Fluid chemicals are piped directly from tank cars to large storage vats on the upper floor of the three-story chemical building, while other dry materials are conveyed to bins and other storage receptacles all on this floor. They work down from third and second floor to process storage tanks in the basement, and are pumped up to the continuous spinners on the first floor by air compressors. All ingredients used in the process are weighed or metered at every stage along the line, and every solution is subject to chemical analysis in the large control and plant research laboratory.

Engineered by Wilbur Watson & Associates, and built by The Hunkin-Conkey Construction Company, both of Cleveland, the buildings include a large office as well as the modern power plant.





(Left) These ammonia compressors have a capacity of 1800 tons of refrigeration. The system handles about 500,000 c.f.m. (Right) Battery of automatically-controlled coal pulverizers, located on ground floor of power house; reduces all coal to a uniformly pulverized state, so that it can be blown to the boilers on the floor above.



Photos courtesy N. Y. State Dept. of Labor, Div. of Industrial Hygiene

Inorganic Dusts and Industrial Dust Control Methods

Dusts of mineral origin include the dusts producing the much dreaded silicosis. Dr. R. R. Sayers, Division of Industrial Hygiene of the National Institute of Health, outlined the characteristics of the harmful industrial dusts, both organic and inorganic, in a paper before the National Safety Congress recently. Here only the concluding part of the original paper is presented. The earlier part appeared in the November, 1938 issue of "Heating & Ventilating" on pages 35 to 37.

INORGANIC compounds are of mineral origin, not requiring a living organism to produce them. A number of dusts not usually classed as toxic may, under some conditions, produce untoward effects on the human organism. Classified under inorganic are toxic and (or) irritant, fibrosis-producing and non-fibrosis-producing dusts.

(a) Toxic and (or) irritant.—Toxic dusts are those which are inherently toxic when inhaled, ingested, or otherwise absorbed. Among those which produce systemic poisoning, some of which are also irritant, are the dusts from heavy metals and their salts, such as lead, mercury, arsenic, cadmium, zinc, and similar metals. Irritant dusts are injurious by reason of their strong irritative or corrosive properties. As a rule, inhaled irritant substances immediately cause a reaction in the upper respiratory tract of such severity that they are prevented from reaching the lungs, although they may cause lung damage by extension of inflammation if the mucous membrane is corroded. Lime, calcium oxide, and the dichromates are examples of irritant dusts. An inorganic dust may possess both toxic and irritant properties, and the poisoning produced may be the combined effect of more than one mode of entrance into the body.

Of the directly poisonous dusts, the most widely prevalent are those of certain lead compounds, particularly the oxide, carbonate, and the chromate. The dust is readily absorbed by the mucous membrane; some dust passes into the stomach and is dissolved by the gastric juice.

According to Fairhall, perforated nasal septum is a common occurrence among workers with bichromate dusts. In a study made by the United States Public Health Service it was found that continuous daily exposure to concentrations of chromic acid mist greater than 1 milligram in 10 cubic meters is likely to cause definite injury to the nasal tissues. It is believed that a similar concentration of the dust would be equally toxic.

In the case of poisoning from some heavy metals, there may be exposure to both dust and vapor. For

instance, investigations have shown the safe limit of *total* exposure to lead oxide dust and fumes to be less than 1.5 mg. per 10 cubic meters of air, except for prolonged exposure. In exposure to mercury dust and vapor, it was shown that the incidence of chronic mercurialism increased rapidly with increasing mercury concentration, after such concentration exceeds 2.0 mg. per 10 cubic meters.

Alkalis and metallic oxides are common causes of dermatoses. Lye, potash, and lime are known to cause irritation to plasterers, cement makers, bricklayers, masons, stonecutters, modelers, and metal platers. Ulceration and perforation of the nasal septum occur among workers exposed to the dust of soda ash; systemic poisoning also occurs from inhalation of calcium cyanimide dust.

Cases of dermatitis, scleroderma, and cancer are reported to have been caused by exposure to dust of arsenic compounds. Certain aluminum salts are skin irritants, and aluminum dusts may contribute to the infection of skin and mucous membranes, through mechanical action.

(b) Fibrosis-producing dusts.—The most important of these are the inorganic, slightly soluble dusts which cause fibrous changes in the lung tissues, some of which are serious, and some of which cause little or no disability. So far as is known, no inorganic substances other than silicon derivatives cause more than a very moderate degree of fibrosis of the lung. Moreover, there seems to be no evidence that any other constituent of ordinary dusts can influence so unfavorably a pulmonary infection.

Although other dusts, when inhaled in sufficient concentrations over a long enough period of time, have been shown to be capable of producing a pulmonary fibrosis, nevertheless, the pneumoconiosis characterized by nodular fibrosis has to date been shown clinically and experimentally to be associated only with the inhalation of dusts containing free silica. Since this dust, to exert its harmful action, must enter the finer divisions of the lung, the particle size of the atmospheric dust may bear a definite relationship to the injurious effect produced. The silica must be present in the air in particles small enough to enter the finer air spaces and of such dimensions that the phagocytic cells may engulf them. The greater majority of particles found upon microscopic examination of the lung fall within the limits of from 1 to 3 microns. Examples of siliceous dusts are granite, quartz, sand, pumice, slate, and similar substances.

The chief distinction between silicosis and conditions due to simple reactions caused by other dusts is the active proliferative reaction in the tissues which results in progressive nodulation. Silicosis, when once established, strongly predisposes the lungs to infection, especially with the tubercle bacillus. Chronic interstitial pneumonia, chronic bronchitis, and emphysema are frequent complications of advanced degrees of silicosis.

The relation of the acute respiratory infections to the reaction due to dusts other than free silica has never been established, though a heightened incidence has often been shown statistically in workers in dusty trades. It is fairly certain that a dust-damaged lung, whatever the cause, fares much worse if an acute infection does supervene upon it.

In a study conducted by the Public Health Service among marble finishers in Vermont, it was found that marble dust, when inhaled in the concentrations found in the examined plants, produced a mild, bilateral, linear fibrosis in some cases, but no serious lung changes were noted and there was no disability due to the dust, even after years of exposure.

(c) Non-fibrosis-producing dusts.—These are inert, that is, they do not cause fibrous tissue to be produced, but may become encapsulated or lie free in the tissues, or they are absorbed without production of fibrous tissue. Included among them are alundum, coal, corundum, emery, limestone, magnesite, marble, plaster of paris (gypsum), and polisher's rouge.

Dust Control

Engineering and medical control are the two most important factors in combating the industrial dust hazard, and are to a large extent complementary.

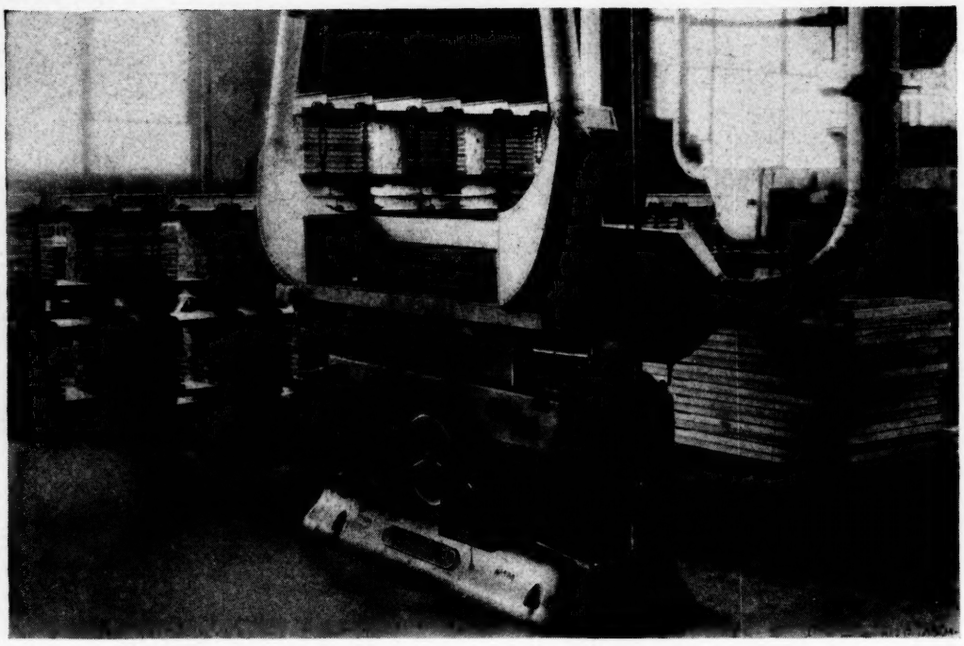
Engineering control.—As Lanza has stated in a recent paper, "It is a basic principle in dealing with a dust hazard that the dust should be attacked at its point of origin and thus prevented from being disseminated into the atmosphere." After the dust has been spread throughout the air it is difficult to deal with it, and reliance must be placed on individual protection, which is never wholly satisfactory.

Lanza further cites various methods used in controlling dust. These will be reviewed but briefly here.

Dust may be entrapped at its source by suction devices and thus removed and collected. Familiar examples are exhaust hoods in grinding operations and the devices used in rock drilling. Generally speaking, the exhaust ventilation method, where applicable, is to be preferred in controlling a dust hazard. Water may be used to entrap dust and prevent its dispersal, and under certain circumstances it may be of advantage to combine the use of water and the use of suction. Sometimes a dusty process can be completely enclosed in a sealed room or compartment. It must be remembered, however, that any mechanical device of this kind offers adequate protection only if it is properly designed, installed, and maintained.

A great deal of attention has been given the subject of individual protection from dust, and there are many types of respiratory protective devices now available. These are generally of two types—those which provide fresh air from an uncontaminated source and those which rely upon a filtering medium for removing dust from the air breathed. Where the use of such a device is indicated, only one of the types approved by the United States Bureau of Mines should be used. As a rule, it may be said that masks, respirators, or other such protective devices should be used only where exposure to the dust is intermittent and brief, or where some unusual condition makes a more adequate dust control impracticable.

Where bacteria or other living dusts in the air are associated with a process, sterilization methods, such as increased temperature, ultraviolet radiation, and chemicals like chlorine or other bactericidal substances, may be of use. Pasteurization temperature (about 140F)



will kill most organisms except those bearing spores. Steam disinfection is used for horsehair, and proves to be practicable if the temperature does not exceed 230F. Wool fibers, however, lose their elasticity by steam disinfection, and the "Duckering" process now used in England includes soaking of the wool in a formaldehyde solution, and drying in a current of air at a temperature of 160F. There are but few occupations in which there would be a sufficient concentration of dead bacteria to cause untoward effects in man.

In the case of dusts producing external irritation, auxiliary protective measures may include the use of protective clothing, gloves, goggles, and aprons, as well as protective salves, ointments, or other compounds to delay or diminish the irritant action. General rules for hygiene and good housekeeping should also be observed.

Medical control.—Equally important, and closely interrelated with the engineering phase, is medical control of occupational hazards. In addition to directing the proper placement of new workers and guarding the health of all employes, medical control is a check on the efficacy of the engineering control methods already instituted, or a measure of the need for new protective devices.

It has been stated that "Industry has found that the best way to treat industrial injuries and illness is to prevent them," and medical control, through preemployment and periodic physical examinations, is one of the most important factors in such prevention.

The preemployment examination is made to determine the employe's physical and mental fitness for work. It serves to disclose the presence of any contagious disease, reveals any minor physical defects which might later become serious, or whether the examinee's condition precludes his employment in certain or in all types of work. It should be remembered that such preemployment examinations are not to be made for the purpose of eliminating or excluding an employe, but rather for allocating him to the type of work for which he is physically suited. A worker should be given employment unless totally unfit, or unless his disability would cause him to be a hazard to himself or his associates. Furthermore, the practice of preemployment examinations should be extended to include executives and officials of industrial organizations.

"The purpose of periodic physical examinations is to secure and maintain physical fitness and thereby lengthen work spans." Reexamination of employes sometimes results in the discovery of defects and disabilities which were not observed at the time of employment. In such cases an occupational adjustment should be made to provide continued employment, and remove the risk of permanent injury. Reexamination of employes is required by law in certain occupations in which the handling of poisonous or otherwise deleterious substances may result in the contraction of disease. Since some occupational diseases tend to clear up and recur, records of previous occupations should be included in the physical examinations. The frequency of examinations should be determined by the medical director, unless otherwise specified by law. Those exposed to known occupational disease hazards may have weekly or monthly examinations.

Stoker Generates Smokehouse Gas

A FORCED draft smokehouse for the tenderizing of hams has been installed by Armour & Company in its Birmingham, Ala., plant. The smokehouse consists of a room 10 by 9.6 ft. in size and reaching four stories high, accessible on each floor.

Smoke is blown into the room by means of a stoker, equipped with sawdust pot, located just outside of the smokehouse. By means of a fan and duct system extending from the top to the bottom of the compartment, the smoke is evenly distributed, part of it is ejected at the top as desired, also fresh air introduced in controlled amounts. The ducts are equipped with fusible link doors as a protection against fire.

In addition to the smoke ventilating system the room is equipped with steam coils, so the desired temperature may be maintained.

Accurate Reduction Gears Cut in Air Conditioned Rooms†

By CHARLES O. HERB‡

REDUCTION gears for the steam turbine drives of ships must be machined to extreme degrees of accuracy in order to obtain successful operation at the customary high rates of speed. The gears mounted on propeller shafts range up to 12 ft. in diameter and run at speeds as high as 400 r.p.m. The pinion in the reduction train may run as fast as 6000 r.p.m.

Double-helical gears of this large diameter are produced at the South Philadelphia Works of the Westinghouse Electric & Manufacturing Company with the pitch diameter accurate within ± 0.002 in. Of even greater importance to gear performance than accuracy of pitch diameter is correctness of the helix angle of the gear teeth, uniform tooth spacing, and correct tooth contour. In the Westinghouse plant, satisfactory turbine gears are the result of maintaining the tooth-cutting machines and their hobs in as nearly perfect condition as possible.

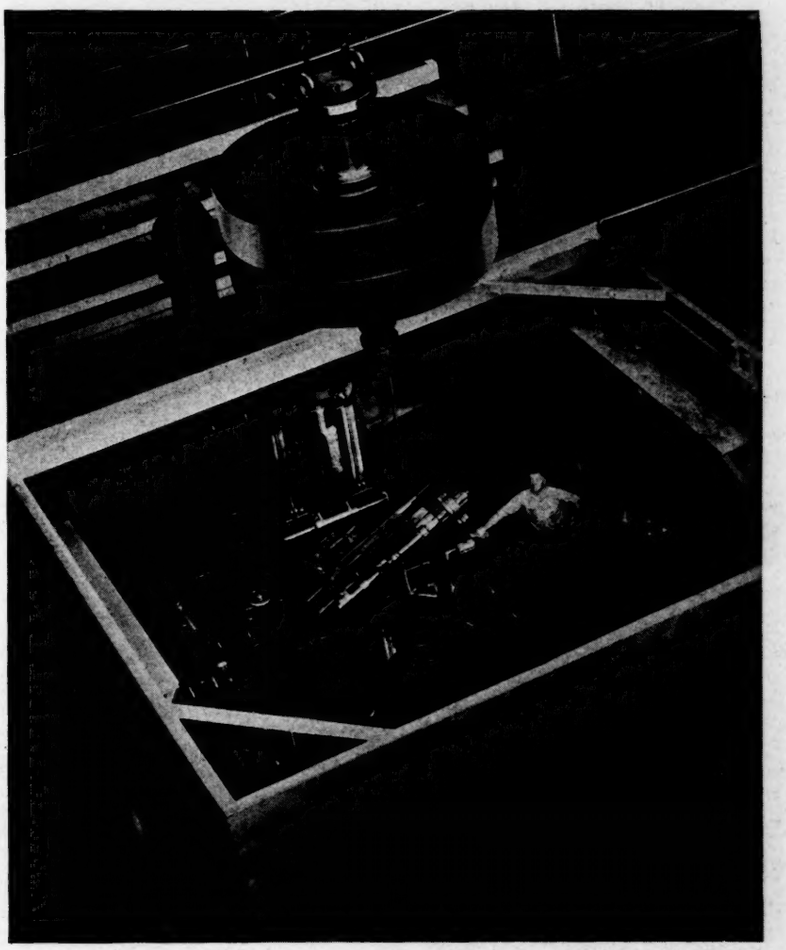
Even with first-class machines and tools, however, certain precautions must be observed during the manufacturing stages to produce satisfactory gears. One important precaution is to maintain uniformity of the operating temperature, because changes in the room temperature will cause inaccuracies in the helix angle of the different teeth, with the result that all the teeth in the finished gear will not come in contact with the full width of the teeth on the mating pinion. Changes in the temperature are also likely to result in an "out-of-round" pitch circle.

The cutting of the teeth on large turbine gears is a matter of weeks, and is performed day and night without stopping the machine, except to change the hob for the finishing cut after the roughing of the teeth has been completed. In cutting a gear of the size seen being lifted from the machine in the illustration, for example, approximately eighteen days are required for roughing the teeth and seven days more for finishing them.

Uniform temperature throughout the cutting of reduction gears has been made possible by the erection of heat-insulating walls and ceilings over the individual gear-cutting machines to form rooms in which an even temperature can be maintained during the entire period of gear-cutting. Cooled air is supplied to these rooms in the summer by refrigerating apparatus, and heated air in the winter. The practice is to maintain the temperature in the rooms at 70F, although the exact degree is not important so long as the temperature existing at the beginning of the operation is maintained to the end. Recording thermometers produce records of any temperature changes throughout the operation, and these records are filed for future reference.

The illustration shows the method of transporting the work to and from the gear-cutting machines by means of an overhead crane after a section of the ceiling has been removed.

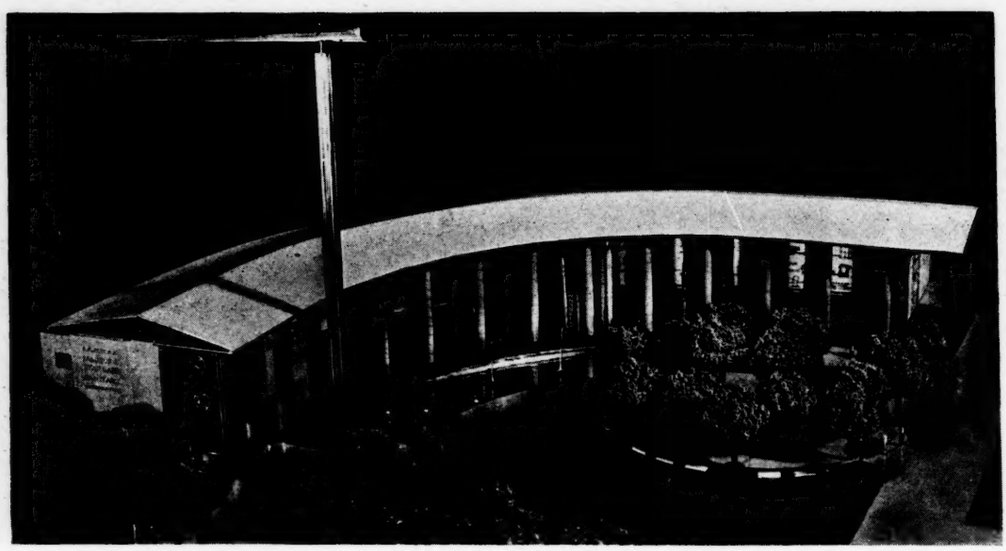
When light weight is required, gears are made of welded steel construction, although many gears are made with cast-iron centers and steel rims shrunk and keyed to the centers. The large gears are turned to the required diameter within ± 0.002 in. prior to the hobbing operation, the gears being mounted on their journals and supported by steadyrests and on centers. With this accuracy in the turning operation, the teeth can be readily cut to the required pitch diameter in the hobbing operation by merely feeding the hob into the gear periphery an amount corresponding to the addendum of the teeth.



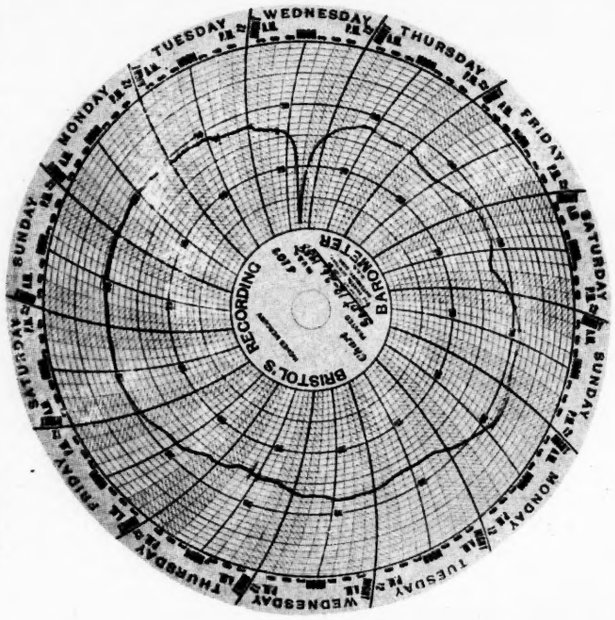
An air conditioned room where turbine reduction gears are hobbed, an operation which may last 25 days, and during which uniform temperatures are maintained constantly. The ceiling is movable to facilitate handling of the gears.

†Abstracted from "Machinery," November, 1938.
‡Associate Editor, "Machinery."

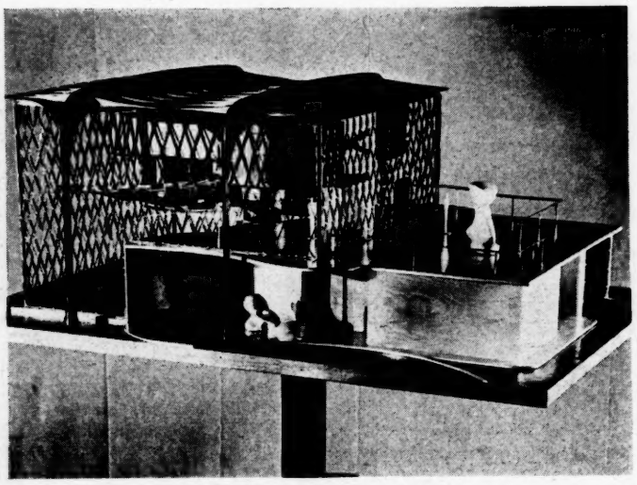
PICTURE PARAGRAPHS

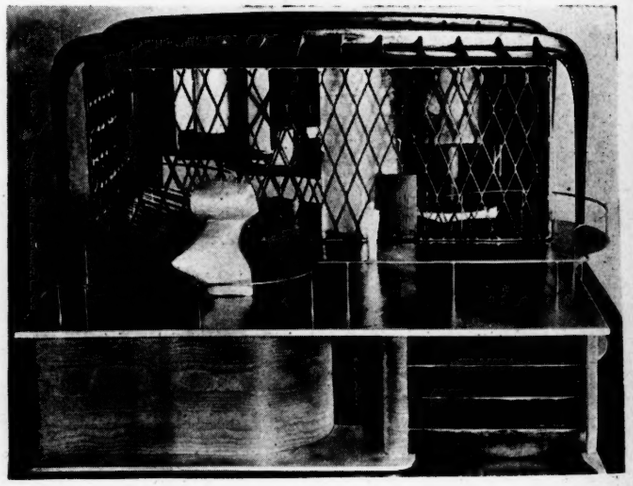


WORLD'S LARGEST WEATHER VANE, 72 ft. long, on a 110-ft. copper mast, will direct attention to American Radiator and Standard Sanitary Corporation's building at the New York World's Fair, 1939. Materials of the industry such as copper tubing, will be utilized for decorative purposes. View shows model of the Weather Vane.

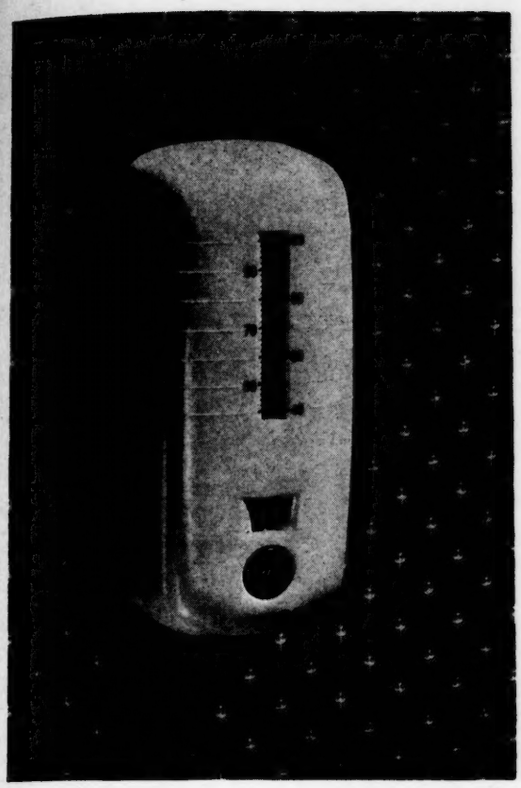


HURRICANE of September 21 was forecast by a Bristol's recording barometer at the company's factory in Waterbury, Conn., chart from which is shown at the right. In few hours reading dropped off calibrated portion of the chart.



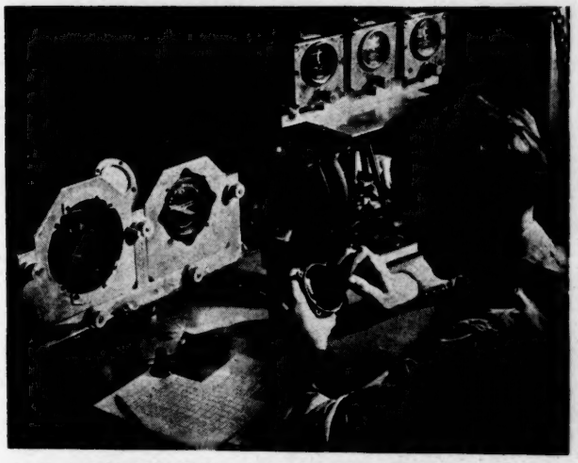


HOUSE OF TOMORROW designed by Paul Nelson, exhibited in model form at the Pierre Matisse Gallery, New York. Interior distribution consists of (1) service group on ground floor, (2) habitation group suspended from roof, and (3) leisure, recreation, and study spaces between. The entire house is to be air conditioned. Upper stories are suspended from an arching monolithic construction executed in metal tubing. Plan involves a marriage of utilitarian space and leisure space and is designed on a hypothesis that assumes a more perfect social state wherein the development of the individual would be essential for collective culture.



PLASTIC THERMOSTAT of radical basic redesign is the new Automatic Products Company thermostat which won an honorable mention in the household group of the Third Annual Modern Plastics Competition, conducted by Modern Plastics magazine. Terminal board, base, and dial are molded of gold-brown plastic with ivory numerals brushed into the dial. Cover is cream colored with brown brushed-in numerals.

BUY THROUGH YOUR ENGINEER, contractor, or architect when purchasing air conditioning, was the advice given by J. Smith Ferebee, Chicago's golfing broker, during his transcontinental marathon. Reuben N. Trane (left) president of The Trane Company, furnished the air conditioned plane in which Ferebee (right) traveled from city to city and played 600 holes of golf in eight cities in four consecutive days.



AIR CONDITIONED LABORATORY where instruments and accessories of the Pennsylvania Central Airlines are tested. The conditioned air keeps dust and moisture out of the precision instruments that guide the company's twin-motored planes. At the end of 650 hours, 50 instruments from each plane are calibrated in this Westinghouse condi.ioned test room.

WALT DISNEY signs a contract for air conditioning of various buildings of his new studios while General Electric engineers look on. The new home of Mickey Mouse, Donald Duck, and Snow White will consist of from 20 to 27 buildings. Air conditioning will be for both comfort and process.

EGYPTIAN OCULIST. Dr. Mohamed Sobhy Bey of Cairo removes a cataract in his Carrier air conditioned operating room. The portable unit is shown at left. Conditioning eliminates danger of perspiration from a nurse or doctor coming in contact with the eyes. Another reason is for comfort of patients who are not under anesthesia.

Care in Installation Necessary for Good Air Cleaning

By H. C. MURPHY†

Air filters have reached a high state of development but they must be properly installed to secure the best results. The author gives suggestions regarding essential points including suitable location of filters relative to the fan, relative to heating and cooling coils, and relative to the direction of air flow. He also urges that sufficient study be given to the location of air inlets so that the filters may not be loaded with unnecessary dirt or odors.

REGARDLESS of the type of equipment used the success of the air filtering system depends to a considerable extent on the care used in installing it. Recommendations for laying out air filter installations are substantially the same as would apply to any other type of equipment through which a uniform flow of air must be passed. Filters are particularly sensitive to improper air distribution and suffer considerably from eddy currents and dead air spaces. Especially if conditions are unfavorable and the arrangement is cramped, the greatest attention should be given to proper distribution of the air over the face of the filter.

Locating Filter Relative to Fan

A filter will operate equally well whether placed on suction or discharge side of the fan. It has become standard practice, however, to locate the filter at the fan inlet, Fig. 1a, for three reasons: (1) simpler duct connections; (2) reduction of static pressure losses; (3) more even air distribution over entire filter area.

Where an exceptionally high standard of dust removal must be maintained it is often advisable to place the filter on the discharge side of the fan, Fig. 1b. This arrangement offers an advantage in that the air pressure on the clean air side of the filter is outward and thus any leaks in the duct will permit the escape of clean air instead of admitting unfiltered air. Another advantage of placing the filter after the fan is the reduction of fan and air noises resulting from the muffling effect of the filtering media.

This type of installation is sometimes recommended for certain industrial applications where a liberal amount of space is available and an extreme degree of air cleanliness is desired.

In ventilating and air conditioning installations, the heating and cooling equipment is usually placed near the air inlet. The recommended velocities through such equipment and filters are about the same and it is convenient to combine their installation which makes simple and economical connections possible. It also saves on static pressure drop as the air passes uniformly through both coils and filter at low velocity and then goes to the fan with gradually increasing velocity.

The ideal location for the filter in such an installation is between the preheater and the other equipment. A preheater is desirable with all types of filters to provide some degree of comfort for winter maintenance. With viscous filters, particularly the automatic type, preheating the air is recommended to maintain the temperature of the viscous material within its most effective range.

If it is not practical to have a preheater then the location of the filter will depend upon the temperature of the air leaving the main heater. If the temperature of the heated air is less than 100F the filter may be placed after the heater, otherwise it should go before the heating surface. Dry filters are not affected by air temperatures and may be located either before or after the heater. An advantage of placing the filter in front of the other equipment in the system is the protection it affords the heating or cooling surfaces from dust deposits.

The distance between the filter and the heating coils must be sufficient to prevent radiant heat from evaporating the viscous coating on the filter screen, especially after the fan has been shut down or as in some cases where the steam is turned into the heaters some time before the fan is started in the morning. A minimum space of 2 ft. should be provided if the filter is ahead of the heater which may serve at the same time as access chamber to the clean air side of the filter.

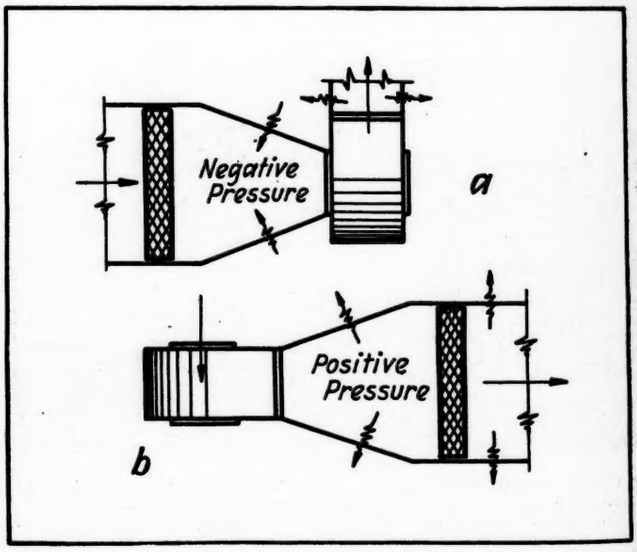


Fig. 1. Location of air filter relative to fan.

†Vice-President, American Air Filter Co., Inc.

Two Filters May be Indicated

One filter may be used for cleaning both recirculated and fresh air, but in many cases separate filters of different types are desirable. This is particularly true in department stores and many industrial applications where the recirculated air contains large volumes of lint which can be best handled by a dry type filter, while viscous filters are preferable for the fresh air because of the heavy atmospheric dust concentration.

In some states recirculation is not permitted in certain types of buildings while in others as much as 75% to 80% recirculated air is allowed which makes it necessary to consult the local code in each case.

The customary air velocities in ducts are several times higher than those prevailing at the face of the air filter. The connections between the filter and the duct system or fan inlet should therefore be sloped as gradually as possible. Best results will be obtained if the incoming air enters the filter chamber perpendicular to the filter. Thus the arrangement illustrated in Fig. 2a is to be preferred to that shown in Fig. 2b.

While it is always desirable to use a filter of nearly equal height and width, it is particularly recommended when the filter is to be placed near the fan inlet. With very tall and narrow or low and wide filters, some parts of the filtering surface may be so far from the fan inlet that the air flow is necessarily restricted, which produces an overload on the remaining area. Filters arranged diagonally, or parallel to the air flow, sometimes suffer for the same reason.

If a uniform air distribution cannot be obtained by ordinary means, provision should be made for baffles or vanes to direct the air flow in the desired way (see Fig. 3). Their position can be determined only approximately in advance and it is best to provide some adjustment for the baffles which may be made after the system is in operation.

When the filter must of necessity be located so the air turns at a sharp angle upon entering or leaving the filter, it is desirable to place the filter as far from the point where the air turns as possible to secure uniform air velocities over the entire filter area.

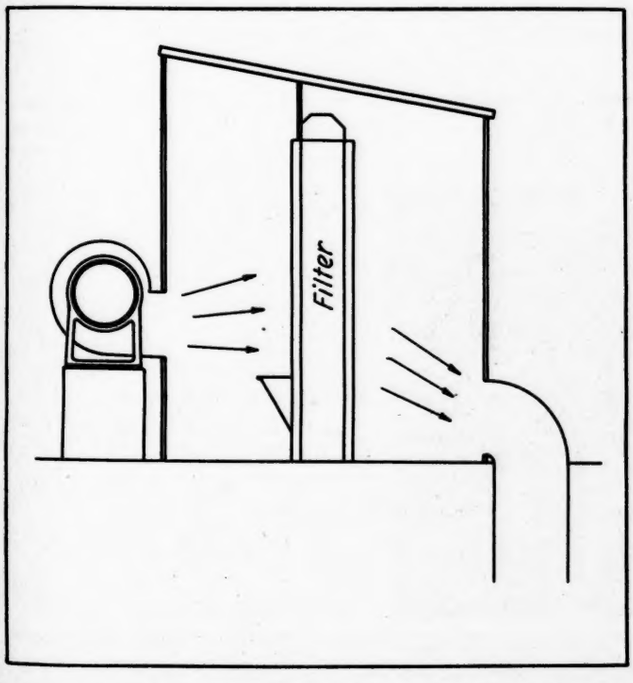
Proper air distribution, because of its effect upon the ultimate performance, is one of the most important factors to be considered in designing an air filter installation.

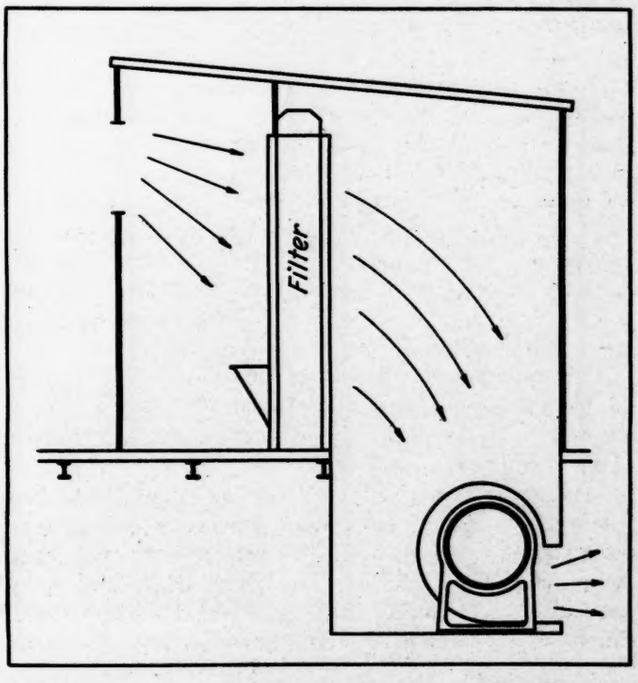
Sufficient Space is Essential

It is important to provide sufficient space in front of as well as behind the filter to make it accessible for inspection and service. A distance of 2 ft. with viscous type filters and 3 ft. with the dry type may be regarded as the minimum. Access doors of convenient size should be placed in the sheet metal connections both in front of and behind the filter. Electric lights which can be switched on from the outside should be installed in order to make possible a more thorough inspection and easier servicing of the filter.

In preparing the layout for a filter installation, serious thought should be given the location of the fresh air intake. Proper consideration should be given to probable sources of fumes, odors, and air-borne pollen. Complete information should always be obtained regarding nearby domestic or industrial activities producing gas vapors, smoke or dust which might be objectionable if drawn into the system.

The intake should be placed as high above the ground or roof line as possible to relieve the filter of the heavy concentration of surface dirt. The use of sidewalk grilles or basement windows for fresh air intakes should be avoided because of the excess dusts, automobile fumes, cigarette stubs, and other refuse to which the system will be subjected. Penthouse intakes should be higher than the parapet walls around the roof to keep out the dust, ashes and soot that settle in such places, and will be stirred up by the air current when the wind blows. Intakes in pits, areaways, passageways between





Figs. 2a (left) and 2b (right). Location of the filter at right angles to the direction of air flow is preferable

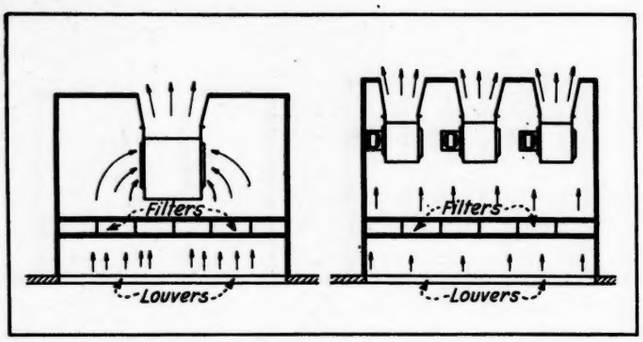


Fig. 3. Much ingenuity is possible in getting a good distribution of air flow through the filters.

buildings and from rear alleys are undesirable as such places are naturally collecting points for dust and debris. A restaurant, newly air conditioned with a fresh air intake in an alley, was troubled with strong ammonia odors. Investigations showed that several horse drawn delivery wagons were unloaded daily near the basement window through which the fresh air entered. A preliminary study of the condition would have saved the trouble and expense of relocating the intake.

The intake should not be so high that it is in line with the neighboring chimneys, and if possible should be located on the side of the building away from the prevailing winter winds. All fresh air intakes should be protected with weather louvers to keep out rain and snow, and covered with ¼-in. mesh screen which should be removable for cleaning. Inlets for recirculated air should be at least 12 in. above the floor. When located less than 7 ft. above the floor they should be equipped with grilles or screens with not more than ¼-in. openings.

If the filter must be placed close to the intake, the openings should be directly in front of, and as nearly the same size of the filter as possible, to assure uniform distribution.

Instructions of the Procurement Division of the U. S. Treasury to their designing engineers for use in laying out Government buildings are as follows. In their instructions the Type A filter is the automatic viscous type, Types B and C are the dry unit types, and Type D is the throwaway or disposable type.

106. Air Filters and Air Washers—Air filters are to be provided for ventilating systems and are to be located on the cold side of heaters.

107. Particular attention should be given to the location of fresh air inlets.

108. In no case should the inlets be near coal holes or near ash removal openings.

109. Inlets through basement windows are objectionable and should be used only where not possible to obtain air from above the ground level. .

110. Type A filters shall be used on units 10,000 c.f.m. to 20,000 c.f.m. where air must be taken through basement window openings, and shall be used on units above 20,000 c.f.m. regardless of where fresh air inlets are located.

111. Type B filters shall be used on all units supplying air to courtrooms and judges' suites only, except where the fresh air is taken from near street level.

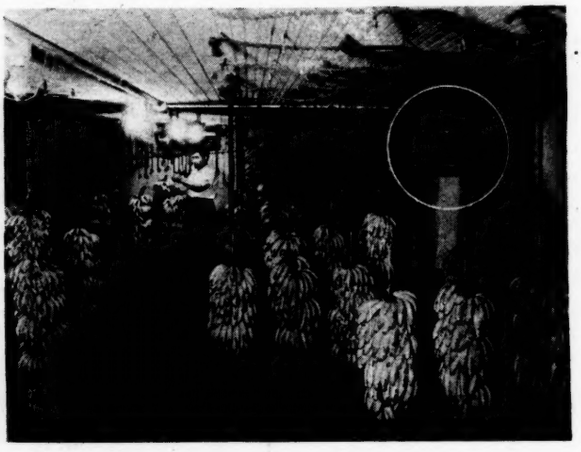
112. Type C filters shall be used on 10,000 c.f.m. to 20,000 c.f.m. units except for courtroom units and except where air is taken from near street level.

113. Type D filters shall be used for all units less than 10,000 c.f.m. except for courtroom units.

Banana Ripening Controlled with Electric Heat

As a result of successfully using a combination of electric heat, humidity and circulated air to ripen tomatoes, a large distributor of fruits and vegetables decided to employ the same methods to ripen bananas, which are cut while still green and brought in that condition from the tropics. A report of the method used was contained in a recent issue of the "Chromalox News." Abstracts from this article follow:

The first step was to prepare two specially constructed warehouse rooms for the purpose. They were equipped with refrigerator-type doors and made practically airtight. Then the equipment intended to provide the necessary heat and humidity was installed suspended from the ceiling, consisting of a water pan open at the top with 4 kw. of electric strip heaters mounted underneath it on an angle iron frame open to the air. The complete assembly is shown inside the circle on the accompanying illustration. A thermostat was mounted on a nearby panel to maintain the desired temperature for the ripening process. The temperature setting is somewhere between 60F and 75F, depending upon how green the bananas are when received and how soon they must be delivered to retail customers. Circulation of the heated air and water vapor is produced by a blower or fan mounted in an opposite corner from the heater-water pan assembly and directed toward it.



Bananas are ripened in this airtight room in from 48 to 60 hr. by the use of controlled electric heat, humidity and circulated air.

The bunches of green bananas are suspended from the ceiling by ropes, as shown in the illustration. The ripening process is completed in from 48 to 60 hours, and the fruit is then held in cold storage until delivered to customers.

A total of 16 electric strip heaters, costing $2.25 each, was used in the ripening rooms. The two thermostats cost $11.35 each, and the water pans were made locally.

Surface Water and City Water Temperatures During the Summer

Surface water temperatures vary more than do ground water temperatures and consequently are less susceptible to mapping than well water temperatures. However, there is a relationship between the air temperature and surface water in most places and, according to W. D. Collins of the United States Geological Survey, surface water in most places will have a temperature not much below the mean monthly air temperature. Mr. Collins, in the United States Geological Survey publication "Temperature of Surface Water for Industrial Use in the United States," has plotted the mean monthly air temperatures in order to show what the probable average surface water temperatures are during the summer months.

The Map

The accompanying map is based on the same general idea except that instead of plotting normal monthly temperatures, maximum monthly temperatures have been used in order to obtain the probable maximum temperatures of surface water, July air temperatures being used for this purpose.

In general, the air conditioning engineer is not so much interested in surface water temperatures as he is in city water temperatures. These may be and often are identical. This is obviously so since many cities depend entirely on surface water for their city supply. However, there are a number of variables which prevent this from always being the case. In some cities the water is supplied entirely from wells. In still other cities both well water and surface water are used, and since in this group there is usually no way of determining what the proportion of the two is at a given time and place, city water temperatures can hardly be predicted closely. In still other places the city water is from surface sources, but the circumstances surrounding its source or storage are such that the temperatures can depart considerably from those which may be expected from the use of data such as are shown in the map.

The Table

The accompanying table shows for a large number of cities the probable maximum temperature of the surface water and also the average July and August temperatures which might be expected in surface water. In addition, the last three columns give data on city water temperatures as determined by a survey covering the year 1936. These city water temperature data are taken from the Department of Commerce publication "Effect of City Water and Sewerage Facilities on Industrial Markets," by O. C. Holleran of the Market Research Division of the Department.

Text continues following Map and Table.

PROBABLE MAXIMUM TEMPERATURES OF SURFACE WATER

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SURFACE WATER AND CITY WATER TEMPERATURES IN THE SUMMER

State and City	Surface Water		City Water		
	Probable Max. Temp., F.	Probable July-August Temp., F.	July Temp., 1936, F.	August Temp., 1936, F.	Source of City Water S=Surface W=Wells
ALABAMA					
Birmingham	84	80	82	81	S
Mobile	84	82	—	—	S
Montgomery	85	82	70	71	W
ARIZONA					
Phoenix	93	90	—	—	S
Yuma	94	91	—	—	—
ARKANSAS					
Ft. Smith	86	82	75	80	S
Little Rock	86	81	88	86	SW
CALIFORNIA					
Fresno	86	82	72	72	W
Los Angeles	74	70	74	76	SW
Sacramento	79	74	80	81	S
San Francisco	62	59	60	60	SW
San Jose	70	67	73	73	SW
COLORADO					
Denver	76	72	71	71	SW
Pueblo	77	74	74	74	S
CONNECTICUT					
New Haven	76	72	—	70	S
DIST. OF COLUMBIA					
Washington	81	77	67	73	S
FLORIDA					
Jacksonville	84	82	86	87	W
Miami	83	82	—	—	W
Pensacola	83	81	70	70	W
Tampa	84	82	85	85	S
GEORGIA					
Atlanta	81	78	84	80	S
Macon	85	81	—	—	S
Savannah	85	80	—	—	W
IDAHO					
Boise	79	74	—	—	—
Pocatello	75	72	—	—	—
ILLINOIS					
Chicago	78	73	68	69	S
Peoria	80	75	56	56	W
Springfield	83	77	80	81	S
INDIANA					
Evansville	84	79	84	83	S
Ft. Wayne	79	74	79	78	S
Indianapolis	82	76	80	82	SW
IOWA					
Davenport	83	76	84	83	S
Des Moines	84	76	66	73	S
Dubuque	82	74	60	60	W
Sioux City	83	75	—	—	W
KANSAS					
Dodge City	82	78	—	—	—
Topeka	87	78	84	80	SW
Wichita	85	79	—	—	—
KENTUCKY					
Lexington	80	76	—	—	—
Louisville	82	79	82	82	S
LOUISIANA					
Alexandria	86	83	86	86	W
New Orleans	85	82	89	90	S
Shreveport	88	83	91	89	S
MAINE					
Portland	72	68	64	66	S
MARYLAND					
Baltimore	81	78	66	70	S
Cumberland	78	74	62	65	S
MASSACHUSETTS					
Boston	77	72	74	73	S
MICHIGAN					
Detroit	79	72	75	74	S
Grand Rapids	79	73	73	74	S
Lansing	77	71	58	59	W
MINNESOTA					
Duluth	72	65	71	67	S
St. Paul	82	72	—	—	SW
MISSISSIPPI					
Meridian	84	80	86	86	SW
Vicksburg	85	81	—	—	S
MISSOURI					
Hannibal	85	77	80	80	S
Kansas City	87	78	93	91	S
St. Joseph	82	79	—	—	—
St. Louis	87	79	85	83	S
Springfield	84	77	74	76	SW
MONTANA					
Helena	72	67	—	—	—
Miles City	78	74	—	—	—
NEBRASKA					
Lincoln	77	85	59	59	W
Omaha	77	85	81	79	S
NEVADA					
Reno	74	70	—	—	—
NEW HAMPSHIRE					
Concord	75	70	72	73	SW
NEW JERSEY					
Atlantic City	76	72	73	68	SW
Trenton	83	76	—	—	S
NEW MEXICO					
Albuquerque	79	76	72	72	W
Santa Fe	71	69	—	—	—
NEW YORK					
Albany	77	73	56	66	S
Buffalo	75	70	71	73	S
Ithaca	76	70	72	71	S
New York	78	74	70	70	SW
Rochester	78	71	68	69	S
Syracuse	77	70	66	70	S
NORTH CAROLINA					
Asheville	74	72	69	74	S
Charlotte	82	79	81	80	S
Raleigh	81	78	83	82	S
Wilmington	83	80	86	84	S
NORTH DAKOTA					
Bismarck	76	70	—	—	—
OHIO					
Cincinnati	82	77	82	81	S
Cleveland	78	72	68	74	S
Columbus	79	75	76	76	S
Toledo	79	73	87	85	S
OKLAHOMA					
Oklahoma City	85	80	77	77	S
Tulsa	—	82	82	82	S
OREGON					
Portland	70	67	62	55	S
PENNSYLVANIA					
Erie	78	71	72	73	S
Harrisburg	79	75	—	—	—
Philadelphia	81	76	79	77	S
Pittsburgh	80	74	81	81	S
Reading	79	75	79	76	S
Scranton	76	72	70	71	S
SOUTH CAROLINA					
Charleston	85	82	83	85	S
Greenville	82	77	76	76	S
SOUTH DAKOTA					
Pierre	82	75	—	—	—
Rapid City	76	71	—	—	—
TENNESSEE					
Chattanooga	82	78	79	80	S
Knoxville	81	77	84	84	S
Memphis	85	81	—	—	W
Nashville	83	79	88	88	S
TEXAS					
Abilene	87	83	75	80	SW
Amarillo	80	76	65	65	W
Dallas	87	84	82	83	SW
El Paso	89	82	85	85	W
Houston	88	83	84	84	W
San Antonio	86	84	76	76	W
UTAH					
Salt Lake City	80	76	58	57	SW
VERMONT					
Burlington	75	70	63	66	S
VIRGINIA					
Lynchburg	82	77	67	73	S
Norfolk	83	79	82	83	S
Richmond	82	78	80	80	S
WASHINGTON					
Seattle	78	64	—	—	S
Spokane	74	70	—	—	W
WEST VIRGINIA					
Charleston	80	77	83	82	S
Huntington	81	76	—	—	—
Parkersburg	80	75	—	—	W
WISCONSIN					
Eau Claire	77	71	51	53	W
La Crosse	79	73	52	52	W
Madison	79	72	52	52	W
Milwaukee	76	70	57	61	S
WYOMING					
Cheyenne	71	67	—	—	—

Variations in Temperature

Where well water is the sole source of city water we expect to find lower temperature city water than that given for surface water and this is usually the case. Frequently, where surface water is the sole source, the temperatures agree fairly well with those given in the column labeled "July-August Temperature of Surface Water." In some cities, however, the temperature of city water departs from what might be expected, as mentioned previously, and there is usually a local reason for this departure. For example, the probable July-August average of New York city surface water is given as 74F, whereas actual temperature in 1936, as shown by the survey, was 70F. The reason for this probably lies in the fact that the New York city water supply comes from a great distance from the city and the reservoirs are under atmospheric conditions much cooler than those existing in the city. The actual city water temperatures in Baltimore are lower than surface water temperatures, due to the great depth of the reservoirs and to the fact that city water is drawn from considerably beneath the surface. Collins ascribes the very warm city water in Pittsburgh (higher than expected surface water temperatures) to the industrial uses of river water in the Pittsburgh region. It is probable that practically all of the variations between city water temperatures and surface water could be similarly explained.

How to Make a Simple Carbon Monoxide Estimator

A NEW device for ascertaining the carbon monoxide content of any given air space has been perfected by the Engineering Department of The Travelers Insurance Co., Hartford, Conn. Almost negligible in cost, and so simple that it can be constructed by anyone with slight mechanical knowledge, of materials obtainable from a hardware store and a drugstore, the device, it is believed, will be welcomed by many who have been unable to make needed tests in the past.

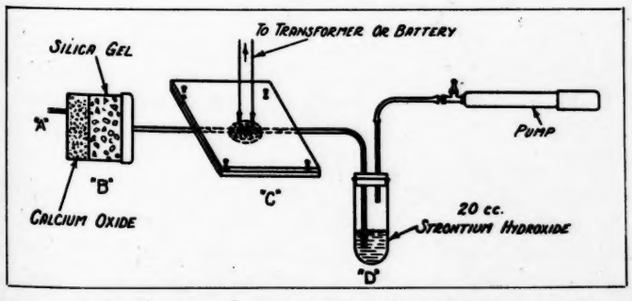
The menace of carbon monoxide has long been recognized in the operation of commercial motor vehicles, garages, and factories. Colorless, odorless, and tasteless, carbon monoxide gives no warning. Exposure for one hour to only fifteen parts of carbon monoxide in 10,000 parts of air may cause collapse. Breathed in sufficiently greater concentration, it causes death. Tests have shown that headache, nausea, excessive fatigue, and general impairing of the mental and physical faculties are common results of inhaling air contaminated with a less than fatal concentration of the gas.

The method depends upon the conversion of carbon monoxide into carbon dioxide by combustion and the reaction of this carbon dioxide with an earth-alkali hydroxide, using phenolphthalein as an indicator. By means of an ordinary bicycle pump, the atmosphere to be tested is drawn through a filter, removing all carbon dioxide and hydrocarbons from the air. The carbon monoxide, remaining unchanged, is then converted to carbon dioxide by drawing it over an ordinary cigarette lighter coil. The product is then bubbled through the alkali solution. With the capacity of the pump known, it is only necessary to count the number of strokes until the color of the solution disappears. By referring to a table computed on the basis of carbon monoxide concentrations that are negligible, slightly harmful, and dangerous, with finer gradations between these divisions, the amount of carbon monoxide in the tested atmosphere is ascertained to a degree of accuracy sufficient for all practical purposes.

The letter "A" designates the inlet to the apparatus. Three-sixteenth-inch copper tubing with brass fittings similar to those on automobile gasoline lines are used. The canister "B" is of tin and should have a capacity of at least 4 cu. in. This canister is two-thirds filled with silica gel and one-third with calcium oxide for removal of hydrocarbon vapors and carbon dioxide respectively. The copper outlet tube from canister leads to the combustion unit "C." This unit consists of two 3 x 3 x ¼ in. pieces of transite board bolted together with 4⅛-in. brass bolts. A suitable central recess is made in one board, as shown, to carry a 19-cent automobile cigar lighter unit. These units are obtainable with one bolt terminal and the other terminal may be made by notching out the head of a small cylindrical headed bolt and wedging the other end of the element in the notch. The edges of the transite board are made air tight by the application of a small amount of furnace cement. The exit tube of the combustion unit is connected to a small bubbler "D" as shown. A suction pump of 55-60 cc. capacity per stroke can be conveniently made from a 10-in. bicycle pump. A 3/16-in. tee is sweated to the bottom of the pump and then two ball check valves to the tee as shown. The current for the combustion unit may be furnished by a toy transformer supplying nine volts or from a six-volt storage battery.

The solution for use is 1/2500 normal solution of strontium hydroxide. This solution is conveniently standardized against 1/50 N H_2SO_4 (0.55 cc. of conc. H_2SO_4 (Sp. gr. 1.84) in one liter of distilled water), 100 cc. of strontium hydroxide solution being equivalent to 2 cc. of N/50 sulfuric acid. Each liter of the strontium hydroxide solution should contain 15 cc. of 0.1% phenolphthalein in 85% alcohol. The strontium hydroxide solution is stable if kept away from air containing carbon dioxide. If 20 cc. of this solution is placed in bubbler and air pulled through at rate of 100 cc. per min. then the following table will apply:

If Red Color (Phenolphthalein) Disappears After	
1 pump stroke	—2000 parts per million of carbon monoxide present
2 pump strokes	—1000 parts per million of carbon monoxide present
4 pump strokes	— 500 parts per million of carbon monoxide present
8 pump strokes	— 250 parts per million of carbon monoxide present
16 pump strokes	— 125 parts per million of carbon monoxide present



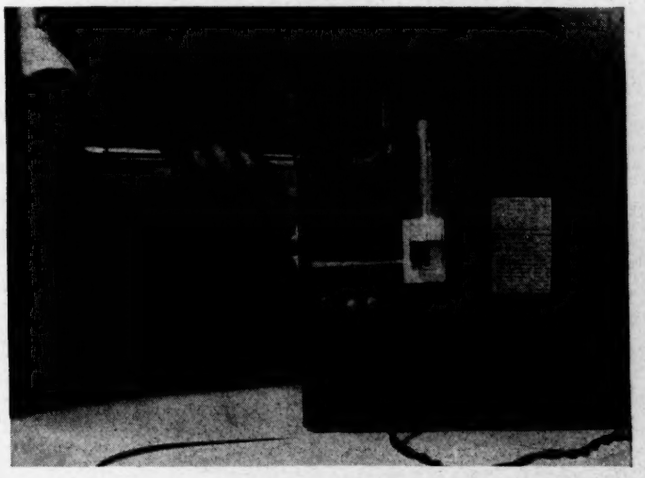


Fig. 1. (Above) Simple apparatus for estimating amount of carbon monoxide in air. Fig. 2. (Right) Closeup view of apparatus for testing for carbon monoxide. Apparatus is housed in an inexpensive metal utility or tool box.

Photo courtesy Photo Div., WPA Federal Art Project

Air Bacteriology—Eliminating Micro-Organisms from the Air

By ARTHUR CECIL STERN†

ANY physical or chemical means which will kill bacteria is susceptible of application to the sanitary control of air-borne organisms. Micro-organisms on glass laboratory ware are destroyed by sterilization in an autoclave, by exposure to high temperature and moisture, or in a hot air sterilizer, by exposure to still higher temperature in the absence of moisture. This suggests heat as an agent in air sanitation, a suggestion which at present appears to be impractical because sterilization involves not only proper temperature, but also retention at the sterilization temperature. It would be thermodynamically absurd to heat a body of air (which subsequently must be delivered at room temperature) to a temperature high enough to kill the organisms instantly. It would be equally impractical to hold the air at a lower temperature for any length of time as is done in the holding tank system of milk pasteurization. However, if it were possible to heat the dust and micro-organism particles in the air without heating the air itself, sterilization could be accomplished by heat alone. A large object, such as a person or a piece of metal, can be heated to very high temperature in cold air by concentrated radiant or induction heating in the absence of any appreciable convection or conduction heating. The author knows of no experiments on the heating of fine dusts or microscopic particles in suspension by these means and can therefore offer no prediction as to its ultimate feasibility as a method of air sanitation.

The heating of air usually associated with room heating, tempering or reheating is not sufficient to accomplish substantial air sanitation and should not be confused with special expedients suggested above. In heating air to room temperature by passage through steam or hot water coils only in the film of air next to the coils is the temperature of the coils approached. The remaining air is heated by convection to relatively low temperatures, certainly not high enough to be germicidal, except to a few easily destroyed organisms.

Liquid Germicides

Next to the use of heat, the most common method of sterilization is by means of chemical germicides. Gaseous fumigants obviously cannot be used for air hygiene. Liquid germicides can be used when they are applied with the wash water in an air washer. As a matter of fact not only is it a practical means of air sanitation to use a germicide in the wash water but it is expedient to do so to prevent contamination of the air from the wash water itself. There is more than one instance on record where the air leaving an air washer contained more micro-organisms in suspension than the air entering it. This can occur when the wash

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water has a high bacterial count. On spraying this water, the evaporation of droplets will leave in suspension in the air the organisms they contained before evaporation. The viability, or ability to survive, of some of these organisms in air may not be very great, so that this initially high count may drop off quite rapidly, but the mere fact that it occurs at all suggests the possibility of spreading infection from wash water to air. Chemicals are frequently used in wash water to inhibit corrosion. By proper choice, chemicals undoubtedly may be found which are both corrosion inhibitors and germicidal to the organisms in the wash water.

Just as some water supplies contain high bacterial counts, others will be encountered which not only have low counts, but also have residual chlorine present resulting from over-treatment with chlorine at the water works. Therefore no general rules can be stated concerning the treatment of wash water with germicides. It is obvious that no germicides should be used which would impart any appreciable odor to the air. This eliminates a large number of the water-soluble germicides now in use. In wash rooms, laboratories or hospitals the public associates the odors of these germicides with cleanliness, but in the home, office, restaurant or theater the odor reminds one of wash rooms, laboratories and hospitals rather than cleanliness, and is therefore considered quite objectionable. Manufacturers of fly sprays and similar fluids utilize what are known as "masking odors" to conceal the unpleasant smell of the product. It has been suggested that masking odors be used with germicides in wash water so that one does not smell the germicide, but instead an odor of faint perfume. This might be acceptable in theater or restaurant conditioning but certainly not in the home or office. In theater or restaurant conditioning, masking odors might have the dubious advantage of also masking the human or body odors associated with crowds.

In selecting germicides for use in wash water, it must be borne in mind that a particular germicide is not equally effective against all bacteria. In fact it may have a high lethal value against one organism and practically none against another. Therefore the choice of germicide also involves a decision as to which organisms are to be destroyed.

There has been some experimental work on the effectiveness of such sprays, but not enough to reach any conclusion other than that this method can be developed to become a really effective means of air sanitation. Whether the eventual application of this method will involve spray chambers, water curtains or wetted surfaces is beyond present prediction, but one thing does seem certain: that some measure of air sanitation can be accomplished in existing equipment without the need of any new equipment except proportioning feeders for the necessary germicidal chemicals. Because these chemicals are an item of expense it is more feasible to employ them in recirculating water systems than to allow the treated water to drain directly to the sewer. Whether or not this method of air sanitation is more economical than other available methods depends on the cost of chemicals and the degree of recirculation of wash water employed.

Air Filters

Another method of air sanitation, now employed in many installations, is the air filter. Since most microorganisms are suspended in air on a dust nucleus, the removal of the dust particle by filtration also effectively removes the organisms from the air. The more efficient a filter is as a dust collector, the more efficient will it be as a remover of bacteria, moulds and yeasts. Dust collectors of the electrical precipitation type which cause the air to pass through a corona will also be effective in air sanitation because not only does the precipitating force remove most of the dust nuclei from the air, but also the corona discharge undoubtedly kills some of the remaining organisms.

Ultra-Violet Lamps

A final means of air sanitation is by irradiation with ultra-violet light. There is perhaps more experimental work now in progress in this field than in all of the others combined. A difficulty which had been associated with the use of ultra-violet lamps, namely, the simultaneous production of ozone in the irradiated air, has been to some extent overcome by better lamp design. Lamps are now being used in hospital operating rooms, food factories, and other places where specific sanitary measures are required, whether or not the air need be conditioned with respect to temperature, humidity, and motion. For instance, in refrigerated rooms where meat is hung to age, proper use of ultra-violet lamps can keep the air sterile with respect to the bacteria of decay, yet allow the moulds needed for the aging process to grow on the meat.

The proponents of ultra-violet air sterilization have suggested several unique methods of lamp utilization, which can not be duplicated by any other means noted. These methods depend on the fact that ultra-violet, being a form of light, travels in straight lines and can be focussed or reflected just as can visible light. Because of this, it can be projected in the form of a band, beam or screen of light across a hall, a doorway, or a room. It has been suggested that in hospitals one bed can be isolated from the rest of the room by a screen of light from the ceiling projected down to the floor on all four sides of the bed. Thus all interchange of air to or from the bed and the surrounding room must pass through a sterilizing screen of light, thus protecting the other occupants of the room from air-borne contamination originating from the patient in the bed and, conversely, protecting the patient from extraneous air-borne infection.

Use of any focussed form of ultra-violet irradiation in a room, as for instance a lamp over an operating table or any of the uses of beams or screens of light just noted, is quite separate from the heating, ventilating or air conditioning provisions of the building. It is possible, however, to install an ultra-violet lamp in a ventilating duct, to focus a beam of ultra-violet light across a duct or an outlet grille from a duct, so that, if its velocity is not too great, the effluent air will be nearly sterile.

The germicidal effect of ultra-violet light is specific with respect to both wave-length and organism. In other words, certain vave-lengths of the ultra-violet

spectra are quickly lethal to certain organisms. It is thus quite important that the source of ultra-violet used in sanitation have these specific wave-bands present. Just as some sources of visible light are yellowish and others bluish, similarly some ultra-violet sources are predominantly in the near ultra-violet (i.e near the visible spectrum in terms of wave-length) and others emit principally in the far ultra-violet range. The spectrum in the invisible ultra-violet region of any lamp is a composite of the spectrum of the actual source of emission of the energy, minus the absorption of the glass, quartz or metal used for reflectors, lenses, windows or bulbs to house or enclose the lamp. It is common knowledge that ordinary window glass or glass used in electric light bulbs is almost opaque to ultra-violet and that fused quartz offers a much higher transparency. Within recent years glasses of higher transparency have been developed and techniques, such as making a portion of the bulb very thin so as to cut down the capacity, have been devised. The prohibitive cost of fused quartz is not the drawback it once was now that moderately priced lamps are available. The source of energy in these lamps is usually an arc in mercury vapor, although other incandescent gases, vapors, and solids also have appreciable emission in the ultra-violet. The exposed carbon arc using coated or uncoated electrodes is another familiar source of ultra-violet but cannot be employed for air sanitation because of the necessity to continually replace electrodes. The emission in the ultra-violet of mercury vapor and other incandescent elements consists of a series of individual line spectra rather than a continuous band of light (invisible though it may be) throughout the range. By individual line spectra is meant that ultra-violet light of a certain wave-length is emitted in the near ultra-violet, then through the spectrum towards the far region there are a number of wave-lengths in which there is no emission, then another discrete wave length at which an emission occurs followed by another band having no emission, another wave-length of emission, and so on.

When ultra-violet consists of a series of discrete wave lengths, certain of the wave lengths are present in greater intensity than others. Furthermore, the power of the glass or metal used as bulb or reflector to absorb ultra-violet is a function of wave length. Because of these many complications it should be obvious that the choice of an ultra-violet source for effective air sanitation is a job best left to experts. The mere fact that a lamp will cause sunburn or produce other phenomena associated with ultra-violet is no indication that it will be lethal to air-borne micro-organisms. The wave-lengths of ultra-violet most effective in producing sunburn are apparently considerably removed from those considered most germicidal.

Counts of Bacteria

The reader who has read the two previous parts of this series of articles and has read through to this point, may have been impressed by the fact that the author has carefully refrained from quoting any figures on the actual quantity or specific types of bacteria to be found per unit volume of air. Investigators of many years ago, who exposed flasks of nutrient broth to the air at sea and in the mountains, were able to report that there were micro-organisms in the air of all locations tested. Recent investigators have exposed petri dishes to the air of the upper atmosphere, the stratosphere, and the air over the north pole. In all such tests micro-organisms or their spores were found to be present although the number of organisms per cubic foot of air at such locations is very small and represents the minimum count for non-sterilized air.

The maximum counts occur in poorly ventilated, crowded rooms and in the vicinity of industrial plants such as distilleries or breweries which utilize micro-organisms to produce fermentation as a part of the industrial operations. Incidentally, this latter fact has been utilized by law enforcement officers to help locate bootleg stills and breweries. By sampling the air in a systematic series of locations covering an area in which a bootleg still is suspected, and spotting these test results on a map, a location showing a maximum concentration of air-borne organisms can be chosen. By repeating this process on a more intensive scale in this latter area, a relatively small area can be ascertained in which the suspected still will most likely be found.

Maximum counts in room air are liable to misinterpretation because of the fact that the dust on the floor of rooms usually contains micro-organisms which have settled out of the air. By stirring up this dust, the bacteria count of the air is greatly increased as long as the air is kept in sufficient motion so that the dust cannot again settle to the floor. The air of a non-occupied room may be quite low before stirring up the dust and quite high after it is stirred up even though

TABLE 1—BACTERIA PER CUBIC FOOT OF AIR IN NEW YORK CITY AT VARIOUS LOCATIONS INCUBATED 18 HOURS AT 98.6F

Type of Location	Sheep's Blood Beef Infusion Agar		Beef Infusion Agar	
	No. of Samples	Bacteria per Cu. Ft. of Air	No. of Samples	Bacteria per Cu. Ft. of Air
Schools	707	29.6	678	21.1
Subway	290	19.2	294	12.4
Theaters—non-ventilated (auditorium)	104	13.2	110	8.4
Theaters—ventilated (ducts)	149	3.1	114	1.4
Streets	143	11.2	134	8.5
Park	13	3.0	18	1.8

STREPTOCOCCI PER CUBIC FOOT OF AIR IN NEW YORK CITY AT VARIOUS LOCATIONS
(Sheep's Blood Beef Infusion Agar)

Type of Location	No. of Samples	All Strepto-cocci	Beta Hemolytic Strepto-cocci	Alpha Hemolytic Strepto-cocci
Schools	553	0.20	0.01	0.18
Subway	225	0.10	0.0003	0.085
Theaters—non-ventilated (auditorium)	78	0.04	0.001	0.038
Theaters—ventilated (ducts)	116	0.03	0.0005	0.026
Streets	123	0.05	0.0001	0.045

the room is still unoccupied. However, the count will decrease as the dust once again settles.

Room Occupancy and Bacteria

In the extensive series of bacterial analyses of New York City air using the Wells centrifuge conducted under the immediate supervision of Dr. Leon Buchbinder and reported before the American Public Health Association in a paper (Am. J. Public Health, Vol. 27, No. 4, April, 1937, pp. 321-333) under the joint authorship of Deputy Commissioner Sol Pincus of the New York City Department of Health and the author, it was shown (Table 1) that there is a definite correlation between type of occupancy of rooms and the average bacteria count of the air therein. The lowest average counts are shown to occur in the air of parks where the human occupancy per square foot is lowest. The next highest average counts were those in streets. All indoor average counts were higher than the two outdoor averages noted. The extent by which indoor counts exceed outdoor counts apparently depends upon the occupancy (number of people per square foot) and the ventilation (number of air changes per hour), being directly proportional to the former and inversely proportional to the latter. Thus the lowest counts in indoor locations were in well ventilated theaters and the highest in poorly ventilated schoolrooms.

The total counts reported represent the total number of colonies appearing on Wells centrifuge tubes after incubation at 68F for 18 hours. The tubes were coated with beef broth agar with and without blood and were each exposed in the centrifuge for ten minutes at an air flow of approximately one cubic foot per minute. Analyses of the bacterial constituents of the total count indicated the presence of a large percentage of gram positive bacilli and cocci of very little pathogenic significance. The leading authorities in this field prefer to place little sanitary significance on the total bacteria count measurement, preferring to use some specific type of organism such as the Beta-hemolytic streptococcus as the index of the sanitary quality of air. They do so on the same basis that the water or food analysts use a specific organism: Esch Coli (the colon bacillus) as an index of the sanitary quality of these substances.

The water analyst has learned that although Esch Coli is harmless to humans it is an almost constant inhabitant of the human alimentary canal and is almost always found in human excreta. Thus to find a high count of Esch Coli in water will, in general, indicate contamination by human excreta or sewage. Such contamination is dangerous not because of the colon bacillus but because the excrement or sewage from an occasionally diseased person may follow the same channels and similarly contaminate the water or food supply in question. Such contamination by, for instance, the organism of typhoid fever, might cause a serious epidemic. To wait for the typhoid micro-organism to actually appear in a water or food supply before taking preventive measures is obviously ridiculous, hence the value of Esch Coli as an easily identified and readily traceable index organism.

Before the discovery that Esch Coli would serve as an index in this manner, sanitarians tried the use of total bacterial counts and other bacterial groups as indices. Total counts were discarded as quite meaningless because of the mass of quite harmless bacteria normally present in water and on food. A high total count does not necessarily mean contamination by potentially disease transmitting sources and a low total count does not disprove it. Therefore as an index organism Esch Coli proved a great boon, and it behooves the air sanitarian to find an equally useful index organism for air which will point to possible contamination by naso-pharyngeal organisms just as Esch Coli does for gastro-intestinal organisms.

In other words air with a high bacterial count is not necessarily harmful or dangerous and conversely air with a low total count may contain organisms by which serious naso-pharyngeal and other disease may be transmitted. Will the index organism to tell whether air is potentially dangerous be Alpha-streptococcus, Beta-streptococcus, or some other organism? The author, being an engineer and not a bacteriologist, eagerly awaits the results of the work of those competent bacteriologists now at work finding the answer.

This is the third and concluding article on Air Bacteriology.

Gas Heaters Save Fruit Shipments

MANY thousands of dollars are lost by shippers of potatoes from the Aroostook section of Maine and by the fruit shippers of the Pacific Northwest in winter through freezing or frost bite of the products, or heat in the heated cars becoming too high and ripening the fruit too quickly or damaging the potatoes, which must have an even temperature. Temperature must be kept at 35F to ensure good condition on arrival. Hitherto cars have been heated by means of charcoal burners in the ice bunkers of the refrigerator cars which are used for transporting the fruit or vegetables, and often the trains had to stop for frequent inspections and heat regulation.

Last winter the Department of Agriculture undertook some tests on potatoes shipped from Maine with a new heater, which burns any kind of compressed gas and is suspended outside and under the refrigerator car. This heater operated on the same principle as a hot water heater for the home, with pipes run between the floor and the floor racks inside, thus distributing the heat evenly to all parts of the space under the floor racks. The warm air rising keeps the fruit or potatoes in the top layer of the carload at about the same temperature as in the bottom layer. Freezing on the return trip of the cars is prevented by an antifreeze solution in the pipes. Between a dollar and two dollars worth of compressed gas will suffice to keep a car at correct temperature on a cross-continental trip. Fifty cars are being equipped by Canadian roads this year with the new device, but so far only two cars have been equipped by United States railroads for experimental purposes.

How Should a Heating and Ventilating Business be Owned?

2. Contractors in Partnership

By CHARLES R. ROSENBERG, Jr.†

FROM a practical business point of view, there's much to be said for the idea of two heating and ventilating contractors going into business as partners. Their combined capital puts them on a sounder financial basis from the outset, and their joint efforts, of course, mean greater impetus for the business. If one is taken sick, the other can carry on the business. These, and many other advantages, make the partnership plan seem attractive.

From a legal point of view, however, the partners are definitely inviting trouble—by the existence of the partnership. When two contractors go into partnership in the operation of a heating and ventilating business, they do not merely add their troubles and hazards as individuals—they multiply them about a thousandfold and involve themselves in countless new complications to which they are not subject as individuals. Of all the ways of being in the heating and ventilating business, partnership is unquestionably and by long odds the worst. Broadly speaking, all the legal "breaks" are definitely against the partners.

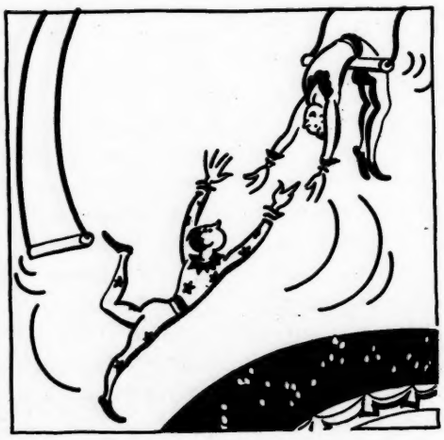
The honesty or dishonesty of a partner is not the only vital factor in a partnership. It's possible to catch up with a dishonest partner and deal with him properly. A partner may be as honest as the sun and still ruin the business. The Potash and Perlmutter stories, while primarily entertaining fiction, were pretty shrewd sidelights on the practical operation of a partnership. Abe and Maurice, you'll recall, were always trying to make slick deals in each other's absence—and usually the firm was thrown for a loss, much to the disgust of the other partner. Under the law, a partner is liable, legally and financially, for all the acts of the other partner done in the course of the partnership business. If one partner makes a losing or stupid deal for the firm, it's too bad. The other partner has to stand for it.

And the law goes a bit further. It says that *each partner is individually liable for all the debts and obligations of the partnership business.* Thus if the partnership business owes a debt and the assets of the partnership are not sufficient to pay it, the creditor may seize the personal and individual assets of *any partner* up to the amount necessary to pay the obligation in full. That means that a partner's home or private bank account, for instance, may be attached to satisfy an obligation of the partnership business. It does *not* mean that each partner is responsible only for his proportionate share of the partnership debts. Emphatically, each partner is personally responsible for *all* the partnership obligations. He has a right to require the other partner to account to him for payment of his share of the debts, but that's apt to be an empty right if the other partner has no personal assets.

Death ordinarily dissolves a partnership business, although this result is sometimes modified by appropriate provisions in the articles of partnership. Ordinarily, too, the surviving partner must account to the administrator of the deceased partner's estate for the value of the dead man's share of the business. The surviving partner must either be able to raise the money to buy the share owned by the decedent's estate, or else the business will have to be sold and liquidated. The widow might be willing to give the surviving partner time to "work it out," but if the dead man had creditors, nothing but immediate payment is likely to satisfy them. Not infrequently, when a partner dies, the assets of the business must be sold to pay off his estate, because the surviving partner cannot raise the cash for the purpose. Thus, death not only ends the partnership, but may destroy the business.

Partners sometimes work out a "limited partnership" arrangement. In a limited partnership the liability of each partner is limited to a fixed amount, so that no matter what debts the partnership incurs, he cannot be held responsible for more than that amount. Statutes in many states provide for the formation of limited partnerships. Even a limited partnership, however, does not avoid the other disadvantages incident to doing business as a partnership.

The third article in this series will deal with the incorporated business.



The risks of partnership are appalling!

†Attorney-at-Law, Media, Pa.

ABSTRACTS of Current Papers, Books and Pamphlets

Combustion in Small Underfeed Stokers

The purpose of the investigation reported in this paper was to study the process of combustion in a small underfeed stoker in the light of the present developed theories of underfeed combustion.

Previous investigations on the underfeed stoker have been restricted to overall measurements with but little emphasis upon the actions occurring at different heights in the fuel bed. Overall measurements may be used to show the relationship between the amounts of fuel and air supplied and the useful heat energy recovered but of themselves give no insight of the mechanics of the combustion process nor do they indicate specific alterations which might be made in design of apparatus or mode of burning to increase the combustion efficiency. This investigation of the small underfeed stoker is unique in that temperature and gas composition data have been obtained simultaneously at various positions in the fuel bed under normal stoker operation and at known overall burning conditions. New information has been obtained on temperature gradients and maximum temperatures, position and extent of the zones of rapid burning, air penetration, ash and clinker formation, and the effect of varying tuyere area and air rate, all of which should aid in improving the design of stoker retorts.

The increased knowledge of the combustion process will help in predicting the operation of the underfeed stoker using other coals of known burning characteristics, and should lead to a more efficient use of the fuel.

The data are of interest from a theoretical standpoint in that they show the progress of the combustion reactions at different levels, give an indication of the heat transfer, and for coke show the limiting burning conditions under which equilibrium operation may be maintained.

[*"Fundamentals of Combustion in Small Underfeed Stokers," by C. A. Barnes, Technical Report No. IV. Published by the Bituminous Coal Research, Inc., 803 Southern Bldg., Washington, D. C. Paper cover; 6 x 9 in.; 69 pages; price, 50 cents.*]

●

Statistics of Building Construction, 1920 to 1937

Since 1920 the Bureau of Labor Statistics has been collecting data on building permits. These data, published annually from 1920 to 1928 and monthly from 1929 to the present, show the trend of construction as measured by the value of permits issued and are important basic material used in forecasting the probable trend and in estimating total construction. The monthly reports show the number of buildings, permit valuation, and families provided for in new residential buildings, and the number and estimated cost of new non-residential buildings, additions, alterations, and repairs, and total building construction. Part I of this bulletin gives the trend of building construction as measured by the value of permits issued. For 1936 and 1937 estimates of the family-dwelling units provided in the total urban area of the United States are shown.

In response to the increasing demand for more detailed information on building construction, in 1935 the Bureau of Labor Statistics undertook the collection of data from the building permit records of more than 800 cities with funds made available by the Works Progress Administration. The Federal Housing Administration, the Home Loan Bank Board, and the Works Progress Administration cooperated with the Bureau in making this study. The building permit survey covered the 7-year period of 1929 to 1935.

Part II of this bulletin summarizes the data compiled in the survey and presents information concerning the number of family-dwelling units provided, classified by cost groups, type of structure, and size of city. The number of family-dwelling units in houskeeping structures for which demolition permits were issued are shown by similar classifications.

Part III, reviewed in these columns last month, presents a review of construction for 1936 and 1937 based on building permits issued in cities reporting to the Bureau. Tables are presented showing the number and cost of each type of building, such as one- and two-family dwellings, apartment houses, amusement buildings, churches, factory buildings and like buildings.

[*"Statistics of Building Construction, 1920 to 1937," Parts I and II, Bulletin No. 650. The Bureau of Labor Statistics, United States Department of Labor. Paper cover; 6 x 9 in.; 42 pages; price, 10 cents. For sale by Superintendent of Documents, Washington, D. C.*]

●

Practical Care of Home Stokers

Intended for distribution among homeowners and stoker buyers, this recent publication makes suggestions for the care and operation of stoker-fired heating systems. Illustrated by colored drawings the booklet shows the cure for all common complaints in domestic stoker operation and includes inspection charts for the rest of the heating system.

[*"Practical Suggestions for the Care and Operation of Stoker-Fired Heating Systems," by, and copyrighted by, Carl J. Klermund, and published by Coal Heat Magazine, Chicago, Ill. Available at $80 a thousand or $12.50 per hundred. Size 4½ x 6¾ in., 34 pages.*]

●

Air Conditioning

Many changes have been made in the second edition of Moyer and Fittz' "Air Conditioning" in order to bring it up to date and to make it more useful for the practical man. Included in the changes are one entirely new chapter, many completely rewritten chapters, and a number of new examples designed to correspond more nearly to the most recent engineering practice. Another new feature is a set of practical air conditioning problems for the student.

The new chapter gives data on sun effect, heat transmission through building materials, and methods of

calculating and selecting the proper size of unit air conditioners.

A list of the chapters includes: Air Conditioning Principles; Ventilation Requirements; Air Filtration; Cooling Methods; Refrigeration for Air Conditioning; Properties of Refrigerants; Types of Refrigerating Equipment for Air Conditioning; Temperature and Humidity-Control Equipment; Design of Temperature and Humidity-Control Systems; Fans and Auxiliary Equipment; Heat Transfer and Unit Coolers; Office Buildings; Theaters; Restaurants; Food Factories and Textile Mills; Railroad Passenger Cars; Air Conditioning for Residences; and Residence Heating with Refrigeration Equipment.

[*"Air Conditioning," Second Edition, by James A. Moyer and Raymond U. Fittz. Published by McGraw-Hill Book Co., Inc., New York. Cloth bound; 6 x 9 in.; 455 pages; price, $4.*]

●

Sampling and Analysis of Coal

A report containing much material of value to chemists and engineers concerned with sampling, analysis, classification, or utilization of coals has been published by the Bureau of Mines, U. S. Department of the Interior, as Technical Paper 586, "Notes on the Sampling and Analysis of Coal." The report is a revised and enlarged edition of a technical paper bearing the same title published in 1914.

Many of the methods of analyzing coal, especially the proximate analysis, are very empirical in nature. The accuracy and limitations of these methods are explained and their relationships to the commercial value of coal are discussed. The Bureau of Mines has developed most of the methods for analyzing coal and coke now accepted as standard in this country. The publication summarizes many experimental data upon which these methods are based.

Besides covering the analysis of coal and the laboratory preparation of samples for analysis, the publication discusses coal ash fusibility and its relation to clinker formation and the classification of coals by rank, that is, according to their degree of metamorphism. The paper is not intended as a laboratory manual for analysis of coal, but rather for showing the significance of analytical results and their bearing on use properties of coals.

[*"Notes on the Sampling and Analysis of Coal," by A. C. Fieldner and W. A. Selvig. Technical Paper 586 of the Bureau of Mines. Size 5⅞ x 9⅛ in.; 48 pages; obtainable from the Superintendent of Documents, Washington; price, 10 cents.*]

BRIEF REVIEWS

Hospital Air Conditioning. An outline of the objectives and special problems arising in the control of ward atmospheres, with special reference to operating rooms, post-operative wards, nurseries for premature infants, fever cabinets or rooms, allergen-free rooms and oxygen chambers, where air conditioning has proved of value. [*"Hospital Air Conditioning," by C. P. Yaglou. Published in the Journal of the American Medical Association, June 11, 1938, pages 2003-2009.*]

Manhole Ventilation. A third report on the investigation of the amount of natural ventilation that takes place in manholes. This report deals with the effect of wind velocity on the ventilation rate. [*"Ventilation of Manholes," Report No. 3—Effect of Wind Velocity on Natural Ventilation, by G. W. Jones, E. S. Baker, and John Campbell. Report of Investigations 3412. Published by the Bureau of Mines, Washington, D. C.; paper cover; mimeographed; 8½ x 11 in.*]

Freon-11. Data on the thermodynamic and physical properties of Freon-11 or trichloromonofluoromethane. Gives the properties of saturated vapor from —40F to 160F, properties of superheated vapor from —40F to 470F, with absolute pressures from 0.7 lb. per sq. in. to 65 lb. per sq. in. Also gives data on specific heat at constant pressure and constant volume, viscosity of the vapor and liquid from —40F to 240F and viscosities of the liquid at saturation pressure from —40F to 140F. [*"Thermodynamic Properties of 'Freon-11' Trichloromonofluoromethane-CCl_3F with Other Physical Properties." Published by Kinetic Chemicals, Inc., 10th and Market Streets, Wilmington, Del. Paper cover; 8½ x 11 in.; 10 pages. Obtainable on request.*]

Summer Relative Humidity. A tabulation of the average per cent of relative humidity at Boise, Idaho, for all hours having a temperature of 90F or higher. Data are compiled from records of the past seven years. [*"Relative Humidity with High Summer Temperatures at Boise, Idaho," by George F. Von Eschen. Published in the Monthly Weather Review, Weather Bureau, July, 1938. For sale by the Superintendent of Documents, Washington, D. C. Price, 20 cents.*]

Air Conditioning Books. A list of 63 recent books on air conditioning with particulars as to their contents, publishers, and prices. [*"63 Recent Books on Air Conditioning." Compiled by the Research Plans and Publications Section of the National Research Council, Ottawa, Canada. Price, 25 cents.*]

Air Conditioning Fires. An article on fires involving air conditioning installations. Contains the reports of 15 fires and indicates the pertinent facts with respect to these fires. [*"Air Conditioning Fires." Published in the National Fire Protection Association Quarterly, National Fire Protection Association, Boston, Mass., April, 1938, pages 325 to 328.*]

Stokers. A report of additional combustion tests of several types of bituminous coal in small underfeed stokers. Three domestic, screw feed, bituminous stokers were tested, one of the conventional type with an automatic air control, the second with an automatic air control and a fuel bed agitator, the third of conventional design but with a device to maintain a constant fuel bed resistance. Coal tested included Wallins, Hocking, Indiana No. 6, High Splint, Millers Creek, Pocahontas No. 3, Sewell, Upper Freeport and Pittsburgh. [*"The Performance of Several Types of Bituminous Coal on Small Underfeed Stokers," by H. R. Limbacher and Ralph A. Sherman. Published by the Bituminous Coal Research, Inc., 803 Southern Bldg., Washington, D. C. Paper cover; mimeographed; 8 x 11 in.; 28 pages; price, 20 cents.*]

(Brief Reviews concluded on page 66)

AIR CONCENTRATION CHARACTERISTICS OF VARIOUS CHEMICALS

1	2	3	4	5	6	7	8	9	10	11
Substance	Molecular Wt.	Density of Gas or Vapor (Air = 1)	Common State L = Liquid G = Gas or Vapor	Odor (NO = Odorless)	Color (NC = Colorless)	Nature[1] of Action	Concentration (p.p.m.) of Substance Which Causes: Nothing Serious After 6 Hr.	Immediate or Subsequent Death After ½-1 Hr. Exposure	Immediate Death	Greatest[2] Allowable Concentration in Parts per Million of Air
Acetone	58.05		L	strong aromatic	NC pale yellow	M on L I to E and L				(100)
Acrolein	46.05		L	strong aromatic	NC	N				39
Alcohol, Grain	32.03		L	characteristic pears	NC	N, E I to E and L	79	198-355		
Alcohol, Wood	32.03	0.596	G			I to L				
Amylacetate			L		NC		37-48	15	1490	2.4
Aniline	93.06		G	garlic	NC	D	2.9	5730-8600		trace
Arsine	77.98	2.695	L	aromatic	NC	D	1440-2790	46,000-61,200	245,000	57.5 (100)
Benzene	78.05	1.539	G	NO	NC		5100	1,600-2,400		16 (100)
Carbon Dioxide	44.0	0.967	G	NO	NC		8			(100)
Carbon Monoxide	28.0									0.63 (0.55)
Carbon Tetrachloride			G	choking	gr. yellow	C, I to L	0.95-1.6	3.16-4.74	790	(10)
Chlorine	70.92	2.486	G	sharp	NC	I to L	4.5	1135-1640		
Hydrogen Chloride	36.47	1.268	G	characteristic	NC	D	16.6-33.2	100-125	350	5.0
Hydrogen Cyanide	27.02		L		NC	I to L	3.4			(85-150)
Hydrogen Fluoride	20.0		G	rotten egg	NC	I to E and L	79-119	395-554	790-1840	
Hydrogen Sulphide	34.10	1.191	G			D	0.6			trace
Lead			Metal			D				
Mercury	200.60		Metal	bitter almonds	brownish		54.6-91			
Nitrobenzol	123.05		G			L				5.0[3]
Nitrogen Dioxide				characteristic				0.03-0.10[3]		(0.80)
Nicotine	48.00	1.655	G							1.0
Ozone				penetrating	NC	L C	21-35	368-552		7-14
Phosgene	34.06	1.2819	G	forms dense smoke			4	490-595		
Phosphine	64.08	2.264								
Sulphur Dioxide	81.37									
Zinc Oxide										

[1]These figures are mg. per cubic meter of air, not parts per million.
[2]Figures without parenthesis in column 11 are p.p.m. as reported established by Russian Industrial Standards. Those in parenthesis are threshold limits as reported by American and British writers.
[3]These figures are mg. per liter, not p.p.m.
[4]Symbols in column 7 have following meanings: C = coughing, D = deadly poison, E = eye, I = irritant or dangerous, L = respiratory system and membranes, M = mild action, N = narcotic effect.

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H. & V.'s REFERENCE DATA—139

AIR CONCENTRATION CHARACTERISTICS OF VARIOUS CHEMICALS

The greatest concentration in air of the vapor of various chemicals which produce noticeable effects on people are frequently necessary in ventilating places where fumes from these chemicals are found. These places are usually industrial plants where the chemicals are present for use in some process and from which use some of the vapors escape and mix with the room air. To avoid dangerous concentrations some method must be provided to keep the general room air so free of the vapors that the concentrations will not be dangerous.

Little is known about the limits of concentration of many dangerous substances and with others the concentration can not be fixed specifically. In columns 8 and 9 of the table on the other side of this sheet most of the concentrations are shown as a range of values indicating that the effect may be expected anywhere in the range since different experimenters have found the effect at different concentrations. The value shown in column 11 is that usually wanted for use in practical ventilation problems. The values as shown in the table are those fixed by authorities whose opinions are believed to be reliable. Most of them are based on observations found as the result of experience in industrial plants when these chemicals have been found in the air. It will be noted that in certain cases there is considerable disagreement between the figures of column 11 as fixed by American writers and those set by Russian Industrial Standards. These differences are due to differences of opinion and practice. In case of disagreement in the figures the decision as whether to accept the American or Russian figures has to be left to the judgment of the user.

Acknowledgment is made to Joseph B. Ficklen, chemical engineer, Travelers Insurance Company, for permission to use the concentrations reported established by Russian standards which are from the book "Estimation of Poisonous Gases and Vapors in the Air," by Zhitkova and Kaplan, and translated into English under the direction of Mr. Ficklen.

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THE MONTHLY QUIZ

Correct answers to the following are on page 62

1. A halide torch is used for (1) lighting large oil burners (2) welding cracks in boilers (3) testing for leaks in gas mains (4) melting solder (5) testing for dichlorodifluoromethane leaks.

2. The relationship among vapor pressure, relative humidity and dewpoint was first made clear in (1) 1925 (2) 1792 (3) 1845 (4) 1911 (5) 1902.

3. The man who first made this clear was (1) Cramer (2) Apjohn (3) Carrier (4) Regnault (5) Fleisher.

4. Insolation is a word meaning (1) a material for reducing vibration (2) a low heat conducting material (3) heat from the sun (4) a type of equipment insurance (5) a metallic refractory.

5. Heat received from the sun on June 21 reaches a maximum at (1) the North Pole (2) the Equator (3) 23½° N. lat. (4) Tropic of Cancer (5) the South Pole.

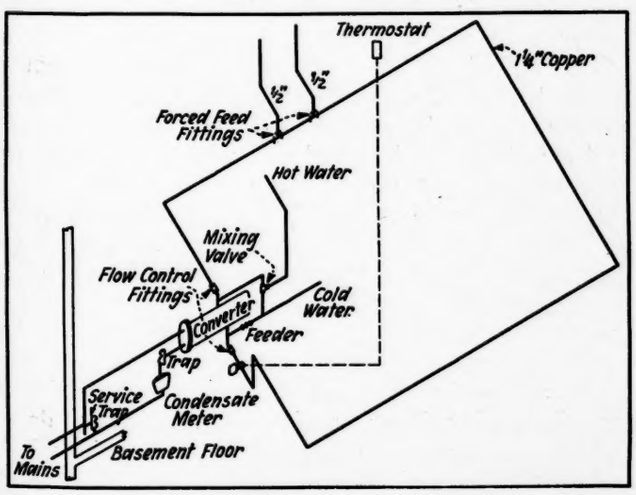
KINKS

Hot Water Heating with District Steam

For small installations of not more than 800 sq. ft. the heating layout shown in the figure has proved economical to install and also satisfactory to operate.

Standard practice with district steam has been the installation of straight steam systems or two-pipe, gravity circulation hot water jobs using instantaneous hot water heaters as converters. The straight steam jobs include a motorized valve if automatic temperature control is desired, and with these systems there has often been considerable noise in mains on the off-on cycle. The two-pipe gravity hot water jobs work quite well but cost considerable more to install. In either, a separate tankless hot water heater using low pressure steam in the shell is used with a combined float and thermostat trap at the outlet end to give rapid drainage.

The system suggested here combines the best qualities of both the alternate systems at a cost considerably lower than either. As will be noted from the diagram, temperature control is provided by operating the pump motor. The converter is installed one size larger than for straight heating so that both heating and domestic hot water supply are furnished. In this connection, where water contains a lot of liming materials it would be better to connect a tankless hot water heater across the two outlets of the converter on the converter side of the flow control valves. This method of connection would still eliminate the trap for the hot water heater.



The saving in piping is considerable due to the low footage and the small sizes used. When using copper tubing with solder fittings the main can be polished with emery cloth and then painted with clear lacquer so as to cut down heat radiation. If desired, the 1¼-in. main can be placed above the basement ceiling line by notching the joists, and the notches can be so placed that the effective depth of the joist as a beam will not be reduced.

The mixing valve is desirable during the summer months when the entire converter load is for hot water and hot water temperatures may rise to an unsatisfactory degree.

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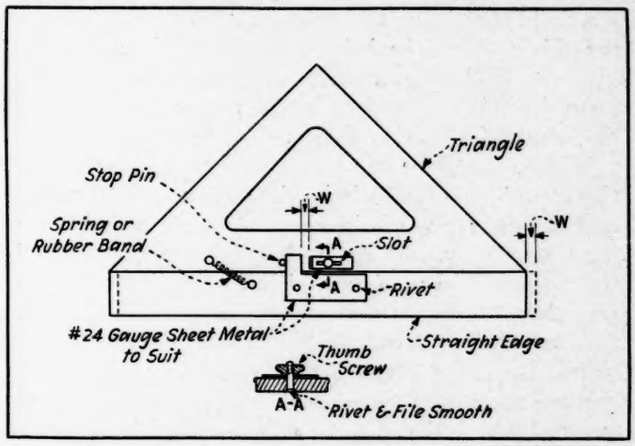
Convenient Cross-Hatching Tool

The accompanying drawing shows a convenient tool for use in cross-hatching and section lining. It is made from a straight edge, 45° triangle, and miscellaneous pieces as shown in the drawing. A thumbscrew adjustment makes it possible to vary the dimensions between the cross-hatching.—*F. C. Holbrook*



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Liberal payment will be made for brief articles which are, in the opinion of the editors, useful and generally applicable kinks relating to drafting room, shop, plant, or field practice in the design, installation, operation, or maintenance of heating, ventilating, or air conditioning equipment. Sketches should be in pencil.

THE PROBLEM CORNER

A cow stood 8 ft. from the center of a railroad bridge when suddenly she noticed a locomotive approaching at 30 miles an hour. She raced for the end of the bridge at the rate of 7 ½ miles an hour If she had run toward the locomotive, she would have just got off the bridge in time, but by running away from the locomotive she was bumped 1 2/3 ft. from the other end of the bridge. How long was the bridge?

If you are doubtful of your solution, see page 62.

EDITORIALS

Air Conditioning Peculiarities

The idea that air conditioning equipment can be applied, installed, adjusted to the load, and put in operation without any special skill persists in some quarters. This in spite of the now large body of experience showing that the contrary is the fact.

The thought that once a well-designed, well-built product is ready for the market all that remains to be done is to go out into the highways and by-ways and pick up local promoters at random to sell, install and service the product is one of those strange quirks of the minds of many otherwise sensible executives.

To some extent it is excusable for similar procedure has sometimes been successful with other products. What is overlooked is that air conditioning products do have peculiar requirements to meet—requirements which frequently are so peculiar to the individual application that unless the applier recognizes them and makes proper allowances the performance of the equipment becomes something other than its maker ever intended. The result all too often is a thoroughly disgusted and disgruntled purchaser, another black mark for air conditioning, and a headache for both the applier and the hopeful executive who fondly imagined that his problems ended when he sent the product out into the field. Fortunately such an executive seldom stays long if he persists in his policy. There is now ample proof that this short tenure is also a fact.

The strange point in this whole matter is that with the record as clear as it is, the new man who appears to take the place of the departed one so often starts the whole story over again. He also is carried away by the value of the product and loses sight of what is required to market it. So on and on it goes.

It would be a most interesting chapter in the story of the rise of air conditioning during the past ten years if some literary genius would give us the full running story of how often inspired outside talent has been imported into the air conditioning field and modestly let it be known that he had decided to make the whole industry over. But the story would lose most of its interest if there were no follow-up to tell the reader what happened to these same geniuses after they departed as wiser if sadder men. Then the chapter should go on to show that most of those who accomplished their objectives were those who decided that perhaps it is best to look at realities and who adjusted their plans accordingly.

After all, what is there so desirable about making air conditioning over into a second automotive industry, a second radio boom, a second kitchen refrigerator bubble? Didn't all these not only have to solve their own peculiar problems, but didn't they also learn that there is grief in this world as well as some successes?

Why not just let air conditioning be air conditioning, recognize its peculiarities and plan to meet them? Instead of denying that skill is required in applying the equipment why not glory in it, train it, and make use of it when acquired?

We believe that the industry should be permitted to develop a personality of its own and that it will do so more and more as time goes on. We also believe that those who still persist in denying the necessity of applicational skill will become fewer in number and of lessened importance. So also do we believe that for some time to come the necessity of applicational skill in this industry will increase rather than decrease.

While it is probably true that the application of particular types of equipment is undergoing simplification it is also true that the variety of equipment available to accomplish a given result is steadily increasing. As this goes on it becomes of increasing importance that the peculiarities of each job be more and more carefully studied and that the equipment be selected with a full knowledge of what it can be expected to do when it meets the test of actual operation. The day may come when application can be reduced to a mere exercise but it is still afar off. Until it arrives there is no use trying to pretend that it is here, and to look on the air conditioning marketing problem as a simple one.

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Standards Develop Slowly

Progress in preparation of equipment performance standards for heating as suggested by FHA appears to be slow. It cannot be said, however, that failure to go ahead rapidly is either surprising or undesirable. There are bound to be many differences of opinion as to what constitutes suitable and workable standards and, moreover, the task of actually reducing the thoughts and principles to written form is a slow and troublesome one. The method of having the interested equipment manufacturers draw up the standards while the government agencies prepare to enforce them is probably as sound a method of procedure as can be devised at present. Certainly it is better to go slow and have the finished result stand a chance of general acceptance than it is to rush ahead and end up with nothing.

The simple truth is that by some means or other the owner or purchaser of home heating equipment is entitled to have some stable basis for judging what he is getting for his money. Realization of this is what prompts all the agitation and attempts to get something worked out. We believe that the result is bound to be brought about and that unless done by cooperative methods there will surely be government imposed rules and standards, or else the incipient moves for standards drawn up by consumers themselves will gradually grow in popularity and influence until they reach a dominating position. The surest way to remove this threat is for the equipment makers to solve the problem themselves. That is why we believe that no matter how difficult or slow the progress may be, there is an essentially sound thought behind the present attempt to get some workable and practicable minimum standards of equipment performance. Failure to do so will represent a failure to grasp an opportunity which may not come again.

NEWS OF THE MONTH

Humidity in Air Conditioning to be Studied at ASRE Convention

NEW YORK — The Hotel Commodore here has been selected as headquarters for the 34th annual meeting of The American Society of Refrigerating Engineers, which will be held December 6-8, with the three main sessions devoted to the newest developments in air conditioning, industrial refrigeration, and commercial and food refrigeration. A feature of the meeting will be the departmental conferences to be held on Tuesday afternoon, December 6, when humidity problems in air conditioning, quick freezing, and market research in refrigeration will be discussed informally to smaller groups, in each case with an authority on the subject leading the general discussion.

The technical sessions proper are to be held only on the mornings of the three days of the convention, with Tuesday afternoon assigned to the departmental conferences, and Wednesday and Thursday afternoons left free for inspection tours, visits to the Power Show, and ASME sessions.

The social program includes a night-club party Tuesday evening, and a speakerless dinner-dance on Wednesday.

The convention program follows:

DECEMBER 6

10:00 a.m.

Topic: Air Conditioning

Air Pollution and Climate, David R. Morris, Meteorological Observatory, New York.

Air Conditioning with Chemical Dehumidification, Stewart E. Coey, Research Corp., New York.

The Present Status of Hospital Air Conditioning, Dr. Albert G. Young, Medical Director, Corey Hill Hospital, Brookline, Mass.

The Possibilities of Gas Storage in the United States, Prof. R. M. Smock, Cornell University, Ithaca, N. Y.

1:00 p.m.

Welcome Luncheon, East Ballroom

Speaker, Watson Davis, Director of Science Service, Washington, D. C.

3:00 p.m.

Conference on Air Conditioning, Milton Kalischer will open discussion with a review of the role of humidity in air conditioning and refrigeration.

DECEMBER 7

10:00 a.m.

Topic: Refrigeration in Industry

Trends in Compressor Design, H. C. Guild, Vilter Manufacturing Co., New York.

Air Conditioning at Low Temperature in Air Craft Engine Laboratories, John R. Monsell, Naval Aircraft Factory, U. S. Navy, Philadelphia, Pa.

Metal and Asbestos Ducts in Air Systems, R. H. Heilman, Mellon Institute, Pittsburgh, Pa.

New Developments in the Use of Ultra-Violet Light in Food Storage, Arthur W. Ewell, Worcester Polytechnic Institute.

DECEMBER 8

10:00 a.m.

Topic: Foods and Commercial Refrigeration

Refrigeration Requirements of the Wine Industry, G. L. Marsh, University of California, Berkeley, Calif.

Refrigeration, Bacteria, and Beverages, Prof. Max Levine, University of Iowa, Ames, Iowa.

Food Freezing Temperatures, Dr. H. C. Diehl, U. S. D. A., Seattle, Wash. (To be presented by Nels Rosberg, Los Angeles.)

USHA Contracts Total $265 Million to House 211,000 Persons

WASHINGTON—One-third of the $800 million authorized for the United States Housing Authority to make self-liquidating loans to cities and towns to clear their slums and blighted areas is under actual loan contract. On November 4 President Roosevelt approved additional loans totaling nearly $33 million for 15 low-rent rehousing projects in 8 cities upon the recommendation of Nathan Straus, USHA Administrator.

The United States Housing Authority so far has signed contracts for loans totaling $265 million for 59 local housing authorities in 21 states and Hawaii to clear their slums and build homes for families in the lowest-income groups.

These projects will provide 52,951 family dwellings to rehouse more than 211,000 persons.

In addition to the $265 million represented in loan contracts, there are outstanding earmarkings of $311 million, making a total of $576 million in commitments for 142 cities participating in the national slum clearance and low-rent housing program.

Franklin Institute to Award Medal

PHILADELPHIA — The Franklin Institute has announced the establishment of a silver medal, known as the Frank P. Brown medal, to be awarded to "inventors for inventions and discoveries involving meritorious improvements in the building and allied industries."

Dr. Henry Butler Allen, secretary, speaking for the board of managers of the Institute, said that the expression "building and allied industries" is intended to include design and construction of buildings as well as appurtenant equipment within this industry.

Mr. Brown, who left the fund for this medal, was born in Reading, Pa., in 1856, came to Philadelphia when quite young and matriculated at the Central High School. He became a member of The Franklin Institute on November 4, 1875; served on the Committee on Science and the Arts from 1879 to 1910, was re-elected in 1933 and continued a member until his death. He was Chairman of the Jury on Lighting at the National Export Exposition conducted by the Institute and the Commercial Museum in 1899. He patented an automatic gas shut-off and devised a soldering machine. In addition to his plumbing business he did considerable metal manufacturing. He was an expert mechanic, and was a member of the Master Plumbers' Association for fifty years and was active in that organization.

25th Convention of Warm Air Group to Celebrate Silver Anniversary

COLUMBUS, OHIO—The National Warm Air Heating and Air Conditioning Association has announced the program for its annual convention and silver anniversary celebrating the 25 years of the Association's continuous activity, to be held December 12-14, 1938, at the Netherland Plaza Hotel, Cincinnati, Ohio.

At the convention Charles P. McCormick, president, The McCormick Co., Baltimore, Md., will talk on "Multiple Managements," and Charles R. Hook, president of the National Manufacturers Association and of the American Rolling Mill Co., will speak on "The Maintenance of the Private Enterprise System."

The Association's new volume, "Forced Air Heating," will be presented, as well as the latest editions of the installation codes.

Tuesday evening all attending the convention are to be guests of the Williamson Heater Company and the American Rolling Mill Company at a banquet and entertainment. The program includes:

DECEMBER 12

Meeting of Board of Directors and Committees.

DECEMBER 13

a.m.

Keynote Message, President L. R. Taylor.

Our Past Presidents, Introductions by President Taylor.

Multiple Management, Charles P. McCormick.

Our Proposed Publicity Becomes a Fact, H. T. Richardson.

p.m.

Standardization and Use of Pre-Fabricated Ducts, Perl S. Miller.

Activities of Our Installation Codes Committee, B. F. McLouth.

Address, Fred S. Wallace, Federal Housing Administration, Cincinnati.

Contented Customers, A. W. Wrieden.

Our FHA Relations Committee, J. Earle Maynard.

DECEMBER 14

a.m.

Our Research Advisory Committee Report, Frank L. Meyer.

Significance of Resistance in a Forced Air System, Prof. A. P. Kratz.

Summer Cooling Studies in Our Research Residence, Prof. S. Konzo.

p.m.

The Standard Test Code for Fans, L. O. Monroe.

The Maintenance of the Private Enterprise System, Charles R. Hook.

Continuous Blower Operation, G. W. Denges.

The Use of Coke with Warm Air Equipment, H. R. Rost.

Toronto Board Forms A.C. Branch

TORONTO, ONT.—The Toronto Board of Trade has formed an air conditioning industries branch. This division will apply safeguards both from the point of view of the purchaser and the industry as well as promote the use of air conditioning.

One-Day Comfort Air Conditioning Congress Held in Chicago; Henderson, Carrier, Leopold, Buenger Among Speakers

CHICAGO—The first session of the National Congress on Air Conditioning For Human Occupancy was held here November 22. Meeting in the auditorium of the Western Society of Engineers, Engineering Building, the Congress was arranged through the collaboration of the Illinois Society of Architects, Western Society of Engineers, Illinois Chapter American Society of Heating and Ventilating Engineers, Chicago Chapter American Institute of Architects, Chicago Association of Consulting Engineers, and Air Conditioning Manufacturers' Association.

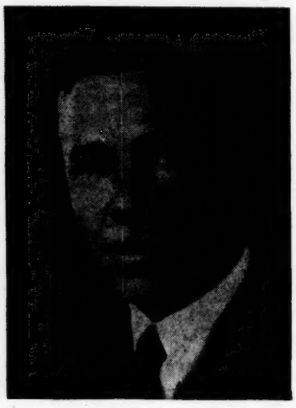
On the program were seven well-known leaders of the air conditioning industry each of whose paper was listened to with close attention by the large crowd in attendance. Papers included The Importance of Air Conditioning Standards, by Dr. Irving S. Cutter, Dean, College of Medicine, Northwestern University; What Is Air Conditioning?, by Willis H. Carrier, president, Carrier Corp.; Structural Items to be Considered in Connection with Air Conditioning, by Albert Buenger, Delco-Frigidaire Div., General Motors Corp.; Engineering Aspects of Air Conditioning, by Charles S. Leopold, consulting engineer; Practical Aspects of Air Conditioning, by Elliott Harrington, General Electric Co.; Refrigeration As Applied to Air Conditioning, by John R. Hertzler, York Ice Machinery Corp.; and Manufactured Products Available to the Air Conditioning Industry, by William B. Henderson, executive vice-president, Air Conditioning Manufacturers' Association.

John Howatt, chief engineer of the Board of Education of the City of Chicago, acted as presiding officer.

Mr. Leopold, in his paper, outlined the engineering aspects of fixing suitable design standards for air conditioning and indicated that in his opinion a suitable maximum limit for summer design conditions was 78F dry bulb and 50% relative humidity. He felt that for winter operation a dry bulb temperature of 70F and 50% relative humidity would be found most desirable. He emphasized that in his opinion one should not lose sight of the fact that the purpose of comfort air conditioning is really expressed by its name. His paper concluded by presenting an outline of the various systems and methods now in use for accomplishing comfort air conditioning. He included those methods wherein drying and cooling are separate functions as well as those wherein both cooling and dehumidification are accomplished at the same time. He concluded that there is no one right or wrong method of conditioning applicable to all comfort installations. In his opinion each project must receive careful study and all the factors must be taken into account in the design.

Mr. Carrier outlined the growth of the air conditioning industry from his early connection with it some 30 years ago and stated that he believes that unless air conditioning is to receive a set-back due to conditions of installation and operation which bring it into public disfavor, it behooves the engineer, the air conditioning manufacturer, and the owner, to see that the equipment is so designed, installed, and operated that it will give conditions most favorable to human comfort and health. That in many cases this is not being done is common knowledge. He predicted that there will be still further improvements in methods of disposal of condenser heat other than by using city water. He also indicated that in his opinion the use of refrigeration storage systems would find increasing possibilities; that there would be more complete standardization of large systems; and that there would be improvements in window construction which will make proper air conditioning possible and practical. He saw no likelihood of any immediate change in the principles involved.

The architects of today, in the opinion of Mr. Buenger, can not be content with being an architectural designer in the full sense. He must be a coordinator of many trades and professions. Air conditioning has added to his problems and responsibility. For example, the equipment room itself presents many problems. It is important that sufficient space be provided to house the equipment and to permit economical duct arrangement and easy maintenance. Moreover, ample water, waste, and electrical connections are important for the successful operation of air conditioning systems. These and many similar construction problems arise in each air conditioning installation. In addition, there is the matter of costs. It is important that the architect be fully informed on this subject. He felt that estimated costs could be arrived at according to the following scale: 1 ton—$500; 2 to 3 tons—$400 per ton; 3 to 9 tons—$325 to $375 per ton; and 10 tons and above—$225 to $350 per ton.



John Howatt, who acted as presiding officer at the National Congress of Air Conditioning.

The recent introduction of unit equipment has tended to bring down air conditioning costs. These costs can also frequently be reduced by certain construction factors with which it is necessary to be familiar. Among these are building insulation; awnings and sun shades, use of proper paints, roof cooling with water, and lighting and electrical equipment loads.

Mr. Henderson believes that there is equipment available of enough diversity so that any comfort air conditioning problem can be solved if suitable equipment is selected for it. He felt that the best way to insure that the equipment is suitably applied is through working with a competent engineer. He pointed out that competent engineering service is generally available.

"In the past fifteen years," he said, "the rapid growth of the air conditioning industry through the demand for comfort has brought its own problems to the industry. There were manufacturers who appended the term 'air conditioning' to their product to add sales appeal, the products so tagged ranging all the way from humidifiers and fans to bread, breakfast food, and underwear. Public education as to the meaning of air conditioning has gone far to solve that particular problem, though we still have a number of these ticks clinging to our industry hide.

"Then the air conditioning industry was accused of creating a water supply and disposal problem. Careful and impartial investigation proved that, while this was true in some instances, in a vast majority of municipalities other causes were to blame. The industry has been foresighted enough to see the possibility of such a situation developing and had perfected water-saving devices such as the evaporative condenser, which re-uses over 95% of the water.

"Careless handling of humidification by poorly-trained, uninformed or profit-greedy installers has contributed to the failure of not a few installations of winter air conditioning to come up to what is to be expected from this fine contribution to better living.

"In buying air conditioning, choose your supplier with the utmost care and with particular consideration of his experience and competence, as well as the good name of the equipment he sells. Quality at a fair price is immeasurably better economy than a makeshift at a cut-rate figure. That is as true of air conditioning as it is of automobiles, shoes, shirts, or ships."

ASHVE to Celebrate Anniversary of Laboratory Founding

NEW YORK—Special emphasis on research, to mark the 20th anniversary of the establishment of the ASHVE Research Laboratory, will feature the 45th annual meeting of the American Society of Heating and Ventilating Engineers to be held at the William Penn Hotel, Pittsburgh, January 23-26, 1939.

Main topics of discussion will be air conditioning in industry as related to health of workers, physiological sensations of comfort, air flow, fuels and the design factors which influence air conditioning applications. The meetings committee has made public the following list of papers to be included in the technical program:

Recent Advances in Physiological Knowledge and Their Bearing on Ventilating Practice, Dr. C.-E. A. Winslow; Cardiac Output, Peripheral Blood Flow, and Blood Volume Changes in Normal Individuals Subjected to Varying Environmental Temperatures, F. K. Hick, R. W. Keeton, Nathaniel Glickman and H. C. Wall; The Role of the Extremities in the Dissipation of Heat from the Body in Various Atmospheric and Physiological Conditions, Charles Sheard, Marvin M. D. Williams, Grace M. Roth and Bayard T. Horton; Skin Temperatures of the Extremities and Effective Temperature, Charles Sheard, Marvin M. D. Williams and Bayard T. Horton; Air Conditioning Requirements of an Operating Room, F. C. Houghten and Dr. Lee Cook; Some Reflection and Radiant Characteristics of Aluminum, C. S. Taylor and J. D. Edwards; A Study of the Heat Requirements of a Single-Glazed Test House and a Double-Glazed Test House, M. L. Carr, R. A. Miller, Leighton Orr and David Shore; Heat Transfer in Storage Water Heaters, D. W. Nelson and A. A. Rosenberg; Practical Methods of Preventing Condensation of Moisture in Walls, F. B. Rowley, A. B. Algren and C. E. Lund.

Responsibility of the ASHVE Towards Solid Fuel Industry, W. A. Danielson; Selection of Solid Fuels from the Viewpoint of the Small Consumer, P. Nicholls; Small Stokers, P. A. Mulcey and R. A. Sherman; Improvements that are Needed in Heating Equipment, T. H. Urdahl; Performance of Stoker-Fired and Hand-Fired Warm-Air Furnaces in the Research Residence, A. P. Kratz, S. Konzo and R. B. Engdahl; Frictional Resistance to the Flow of Air in Ducts, F. C. Houghten, J. B. Schmieler, John Zalovcik and Nicholas Ivanovic; Air Conditioning in Industry, W. L. Fleisher, A. E. Stacey, Jr., and F. C. Houghten.

Limitations of Smoke Abatement Problems and Practical Methods for Their Elimination, H. B. Meller; Relation of Rank of Coal to Smoke Producing Tendencies, H. J. Rose and F. P. Lasseter; Air Filter Performance as Affected by Low Rate of Feed, Various Types of Carbon, Dust Particles Size and Density, F. B. Rowley and R. C. Jordan; The Effect of Heat Storage and the Variation in Outdoor Temperature and Solar Intensity on the Heat Transfer Through Walls, J. S. Alford, J. E. Ryan and F. O. Urban; The Determination and Practical Application of Weather Design Data, T. H. Urdahl, John Everetts, Jr., and J. C. Albright; The Flow of Heat Through Walls, F. E. Giesecke.

Boston District Steam Gains 10%

BOSTON—Edison underground steam business has increased 15% in the 11 months of 1938, and $150,000 has been added to gross income. The utility recently completed about a mile of underground pipe to new customers, the largest of which is the Massachusetts General Hospital.

Heating Contractors Board Meets, Appoints Committees

PITTSBURGH—The Board of Directors of the Heating, Piping and Air Conditioning Contractors National Association met at the William Penn Hotel here October 14 and 15 with the following members present: George H. Dickerson, chairman; James M. Anderson, M. J. Chagnard, Frank E. Kise, L. L. McConachie, William J. Olvany, S. Austin Pope, H. Merwin Porter, George J. Stoehr, and Joseph C. Fitts.

The board voted to waive the initiation fee until the next convention and asked that the membership committee, the affiliated local associations, and the individual members put forth every effort to make the 50th year an outstanding year in bringing in new members.

A committee consisting of S. Austin Pope, chairman; George J. Stoehr, and L. L. McConachie was appointed to draft rules providing for associate membership.

A suggestion that the association investigate the Fair Trade Practice Acts adopted by a number of states resulted in the appointment of a committee consisting of William J. Olvany, chairman; S. Austin Pope, and Frank E. Kise to study this subject and report to the board.

Mr. Dickerson reported that he had appointed a committee of manufacturers of air conditioning apparatus and invited them to cooperate with the Committee on Air Conditioning in solving problems of common interest.

It was also recommended that the Committee on Standards undertake the establishment of national standards for compressor ratings.

Plane Heating Described by Price

SEATTLE—Heating and ventilating of modern sky-ships, big cabin cruisers, and other planes, was the interesting topic taken up by engineers and students at the first November gathering of the Engineers Club of Seattle in the Arctic Building here.

The problems which have developed with growth of ever larger planes were discussed by Nathan C. Price, heating and ventilation engineer of the Boeing Aircraft Company, which is building big planes for domestic use as well as for military establishments and governments all over the world. His talk on Heating and Ventilation Systems in Large Modern Aircraft followed the dinner meet of the engineers November 2 and was illustrated with slides, photographs and drawings that gave intimate details of methods of heating and ventilating.

Under particular study from an engineering standpoint was the new 41-ton clipper ship built in Seattle and launched on Puget Sound during the summer months.

Oil Burner Systems to be Certified; Laboratory Testing Considered

NEW YORK—At a meeting at the Hotel New Yorker here on November 15 called by the Oil Burner Institute, oil burner manufacturers received the report of a Committee on Standards of Oil Burner Institute appointed at the Philadelphia meeting held October 12.

The general assignment of this Committee was to draw up a program which would meet the needs of a minimum requirement suggestion originating with FHA.

Frank H. Dewey, president of the Institute, and general manager of the air conditioning division of Gar Wood Industries, turned the meeting over to R. M. Sherman, Silent Glow Oil Burner Corporation, as chairman of the Standards Committee. Mr. Sherman then presented a four-point program.

The four points suggested were (1) the establishment of certified warranty and installation data on a written certificate prominently displayed with each installation; (2) that all oil burner installations be made only by properly qualified dealers capable of giving service; (3) the establishment of a program of industry commercial standards perhaps operating through the National Bureau of Standards; (4) a program of laboratory testing of burners perhaps involving the use of a seal of approval.

Following the presentation of the program the meeting formally agreed with the work of the Committee in principles and then adopted parts 1 and 2 of the program. It is hoped that the approved parts of the program may be put into effect by January 1.

The Committee on Standards was instructed to continue its work in connection with parts 3 and 4 of its program with the understanding that further meetings would be called in the future to act on such proposals as the Committee might prepare.

Acting for Federal Housing Administration in the move to prepare standards was R. K. Thulman, mechanical engineer, Washington, D. C. Dr. I. J. Fairchild, of the National Bureau of Standards, was present at the meeting and explained the commercial standards of procedure at the Bureau. Representatives of the Home Owners Loan Corporation and of several other government lending agencies were also present. It is anticipated that if acceptable standards can be prepared all of the government's lending agencies will adopt a uniform procedure.

Members of Oil Burner Institute Standards Committee are R. M. Sherman, Silent Glow Oil Burner Corp.; N. F. Curtin, secretary; T. H. Smoot, Anchor Post Fence Co.; A. F. Reif, Reif-Rexoil, Inc.; R. G. Whipple, Harvey-Whipple, Inc.; C. Muirhead, Williams Oil-O-Matic Heating Corp.; and W. O. Lum, General Electric.

Mauretania to be Air Conditioned

LIVERPOOL, ENGLAND—The air conditioning plant being installed aboard the new Cunard White Star liner *Mauretania*, which will enter service next spring, has been designed to provide comfortable conditions of temperature and humidity in the principal public rooms under all weather conditions likely to be met with in trans-Atlantic or pleasure cruising service. In hot weather temperature reductions up to 15F will be possible, while in warm, humid weather the relative humidities will be as much as 35% lower within the rooms served than outside. A winter design temperature of 10F has been used in the heating calculations.

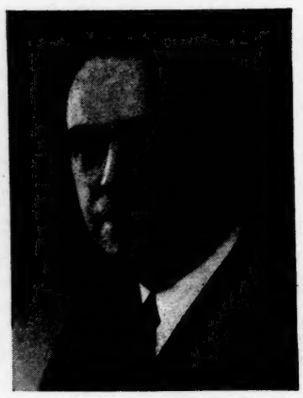
The cabin restaurant will be served by two plants of equal capacity while other rooms will be served by a separate plant. These plants have a combined capacity of approximately 60,000 c.f.m.

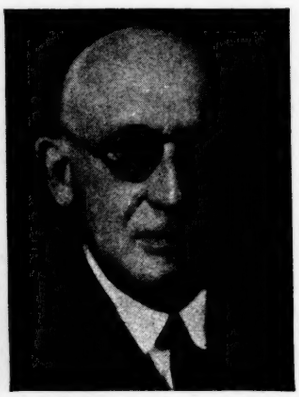
Hoffman Heads Industries Bureau

CHICAGO—"The Bureau is just beginning its period of greatest usefulness to our industries," said Wm. M. Byrd, Jr., president of the Plumbing and Heating Industries Bureau, in his report to the annual meeting of members of the Bureau, held here October 26.

George E. Hoffman, manager, Plumbing and Heating Department, Crane Co., was elected president of the Bureau for the ensuing year. Other officers elected were Wm. A. Brecht, president, Hajoca Corp., Philadelphia, vice-president; Charles K. Foster, first vice-president, American Radiator Co., Chicago, reelected treasurer; and Norman J. Radder, Chicago, reelected secretary.

Mr. Byrd in his annual report called particular attention to the gradual but significant increase in the Bureau's budget since 1933, indicating a growing appreciation by the industry of the importance of the Bureau's work. Special emphasis was put on the desirability of a slightly larger budget for the coming year to enable the Bureau to increase its publicity activities.





(Left) G. E. Hoffman, recently elected president, and C. K. Foster (Right) reelected treasurer, of the Plumbing and Heating Industries Bureau.

Baker, Mills Make Deal with I.T.&T.

NEW YORK—Through two additional contracts signed with midwestern manufacturers by the International Standard Electric Corporation, world-wide manufacturing and sales subsidiary of the International Telephone and Telegraph Corporation, the I. T. & T. system is now equipped to supply a complete line of electric refrigerators and air conditioning products, according to *The New York Times*.

The new contracts are with the Mills Novelty Co., Chicago, and the Baker Ice Machine Co., Omaha. Recently I. T. & T. consummated a contract with the Gibson Refrigerator Company. That company provides a household refrigerator, Mills Novelty the smaller size industrial icing and refrigerating units and Baker Ice supplies the large icing machines and air conditioning equipment.

The contracts provide for manufacturing rights and technical assistance, and I. T. & T. plans eventually to manufacture these equipments in several European factories. For the present, however, they will be exported and marketed abroad under the Standard Electric trademark.

Northwest Group Gets Golf Trophy

SEATTLE—To promote good-will among the Pacific Northwest heating and ventilating engineers, a beautiful new silver golf trophy has been presented to the local ASHVE chapter. It will be known as the Hurly Trophy. The trophy will remain the property of the chapter, but will be held for a year by the winner of the final of four tournaments, in which handicaps will be readjusted after every play for the next tournament.

A turkey dinner at the Rainier Golf and Country Club was enjoyed by the golfing engineers at the close of October, when awarding of the prize for the day's play was accorded.

ASHVE Meets with Canadian Group

MONTREAL, QUE.—The council of the ASHVE recently held a joint meeting here with the Engineering Institute of Canada, in the Windsor Hotel. The session, which was well attended, was the council's first in Montreal. The gathering was addressed by J. H. Walker, Detroit, on Air Conditioning a Glass Brick Building, and by J. F. McIntire and Walter L. Fleisher who spoke on the work of the research committee. Joint chairmen were B. R. Perry and G. L. Wiggs.

Houghten Talks on Textile Plants

PITTSBURGH—The November 14 meeting of the ASHVE Pittsburgh chapter was presided over by President John F. Collins, Jr., who opened the meeting by giving a report on the activity of the chapter for the past year and outlined suggestions to be taken up by succeeding officers.

The research committee, consisting of the degree-day, summer air conditioning, and air pollution subcommittees, also read its reports.

F. C. Houghten was the main speaker of the evening, his subject being "Air Conditioning in Industry." A general outline of the origin of the ASHVE research laboratory, which started its work 19 years ago, was given. The speaker also explained how the effective temperature data came into being. This work is still being carried on at present through the cooperation of several concerns such as the Metropolitan Life Insurance Co., Federal Reserve Bank of Washington, an office building and a hospital.

The Research Laboratory has recently made a detailed study of the physiological conditions approaching those found in the textile industry. The methods used in order to get results in this study were found to be most interesting. The findings were illustrated in slides showing graphs and tables of the various body changes during 3-hr. exposures. Some of these were the physiological response of the relation between rise of body temperature above normal with relation to the increase of pulse from normal. The other factors dealt with the changes of the vital capacity, leucocyte count of blood, systolic and diastolic blood pressure, metabolic rate, weight loss, perspiration and feeling of warmth and effective temperature.

F. M. Farmer Elected by Foundation

NEW YORK—Frank Malcolm Farmer, vice-president and chief engineer of the Electrical Testing Laboratories, New York, has been reelected chairman of the Engineering Foundation, research organization of the major national engineering societies, for 1938-39. Mr. Farmer, who enters upon his third term, is an authority on electrical measurements, electrical insulating materials, testing of engineering materials, and high voltage cables.

George E. Beggs, professor of civil engineering at Princeton University, was elected vice-chairman. J. H. R. Arms will continue as secretary and Otis E. Hovey as director. The executive committee is headed by Mr. Farmer. Other members are A. L. J. Queneau, metallurgist of the United States Steel Corp., New York; Prof. W. I. Slichter of Columbia University, K. H. Condit of the National Industrial Conference Board, New York, and Professor Beggs.

FHA Has Insured $115 Million in Loans for Heating Plant Improvement

WASHINGTON—Property improvement loans insured by FHA have crossed the $700 million mark, Administrator Stewart McDonald announced November 26.

The total amount of these loans, which are insured under Title I of the National Housing Act, was $704,959,409 on November 19. This figure was composed of 1,768,536 separate notes. Of the total, 312,609 notes in the amount of $143,987,310 have been insured since the property improvement credit plan was revived as a result of amendments to the National Housing Act in February.

The major part of the number and amount of these loans since February have been for improvements to small residential dwellings of one to four families and for new structures, Mr. McDonald said. Approximately 87% of the number of loans and 75% of the amount of loans through September 30 were for new structures or improvements to small residential dwellings.

Structural alterations and additions and roofing bulked together comprised the major item of expenditure for 31.5% of the aggregate of loans insured between February and September 30. Alterations and additions represented 23% of this amount, and roofing represented 8.5%.

Heating and plumbing were the major items of expenditure for 23.9% of the total amount of notes reported, with 16.3%, or $115 million, for heating and 7.6% for plumbing.

For 26.5% of the total amount, the major expenditure was for exterior painting and interior finishing. The remaining 8.3% was miscellaneous.

St. Louis Burner Men Back Campaign

ST. LOUIS — Paced by an extensive and vigorous advertising campaign, the newly organized St. Louis oil burner association—Approved Oil Heating Associates—last month reached the peak of its drive to recapture the local heating market. Prepared and executed by the Shell Petroleum Corporation, the campaign has used bill-boards, newspapers, and mail.

Already the drive is said to have injected new life into the local oil heat market which has suffered badly in late years from aggressive gas and stoker competition. In 1936, for example, new oil burner installations in the St. Louis area totaled only 875, while an active sales campaign by the gas utilities netted 1,800 new gas installations. Last year when St. Louis passed a new anti-smoke ordinance which raised the cost of soft coal, a group of burner distributors drew up plans for the new burner association.

Economist Speaks at Boston Dinner of Air Conditioning Bureau

BOSTON—Members of the Air Conditioning Bureau held their first dinner of the season November 17, with the local ASHVE and the Boston Oil Burner Associates participating. Speakers at the meeting that followed were Frank H. Dewey, president of Oil Burner Institute and general manager of the Air Conditioning Division, Gar Wood Industries, Dr. Herman F. Arendtz, staff economist of the United Business Service, and Julius Daniels, sales manager of the Boston Edison Company, past president of the Bureau.

Future Markets for Automatic Heating was the subject of addresses by Messrs. Dewey and Daniels, and Business Prospects for 1939 that of Doctor Arendtz. It has been the practice of the Bureau every year to have some leading business economist address the members on business prospects for the coming year. Following the meeting there was open forum discussion and answers to questions from the recently established Question Box. In this members drop any questions they wish answered by various technical speakers at the meetings, and also suggestions for subjects to be considered at future meetings.

Mr. Daniels outlined the work of the Edison Company following the big hurricane of September, when two-thirds of Edison's 450,000 customers were without electric service for several days. By bringing in line crews from all over the northeast, as far south as Virginia and west to Chicago, the company succeeded in restoring service to the majority of customers within a three-week period. "This illustrated the efficiency of modern power companies," he said. It cost the utility $1 million for repairs.

Frank H. Dewey told the members how he had to hunt to find an oil burner when he built a home back in 1916, and then hunt around for a plumber and pipe fitter to install it. In 1938 every prospective home builder is overrun with people trying to sell him an oil burner. In 1936 there were 2000 new homes erected in or near Boston; in 1938 this number was increased by 2550, and up to November 1 of this year 2000 more had already been built. This is the peak of the building season here now, whereas last year March and April was the peak season. Home building in September was 52% ahead of the same month last year and October was 55% ahead. He predicted a bright outlook for the automatic heating and air conditioning business in the near future.

Doctor Arendtz told of the economic forces that had governed conditions of the last five years and showed the difference in the philosophies of the New Deal and that of private business.

Fiber Glass Products to be Made by Owens-Corning Concern

NEW YORK — Owens-Illinois Glass Company and Corning Glass Works, at a press exhibit at the Waldorf Astoria here, announced the formation of Owens-Corning Fiberglas Corporation, which will produce a variety of products made from fiber glass. The announcement, made jointly by Amory Houghton, chairman of the board of the new company, and Harold Boeschenstein, president, marks the culmination of development work by the two companies involving expenditures totaling about $5 million.

The new corporation is financed jointly by Owens-Illinois and Corning, and is an independent corporate structure. It will not operate as a subsidiary of either parent company and no stock will be offered to the public.

One of the most interesting applications of the fiber glass is to electrical installations. Because of smaller bulk, electric motors of a given horsepower have been constructed which are more than one-third smaller than those using other insulating materials. Being impervious to acids, and unaffected by moisture, the new material promises to solve many industrial problems where other materials have failed. For instance, motors operating at heavy overloads and under adverse atmospheric conditions are now being constructed with fiber glass insulation, with resulting reduction in maintenance costs and costly delays.

Pipe covering for high temperature and refrigeration lines, fiber glass blankets for steam turbines which operate at the maximum practical temperatures without damage, sound insulation for airplanes and other structures are also among the applications of fiber glass. One of the first applications was in air filters for heating and air conditioning systems.

In addition to Mr. Houghton, who is president of Corning Glass Works, and Mr. Boeschenstein, who has resigned as vice-president and general manager of Owens-Illinois Glass Company to head the new corporation, the officers of the new enterprise are: Games Slayter, vice-president; W. P. Zimmerman, vice-president in charge of manufacturing and sales; G. E. Gregory, general sales manager; A. C. Freligh, secretary; H. R. Winkle, comptroller.

Smith New AGA Publicity Director

NEW YORK—According to an announcement by Eugene D. Milener, secretary, industrial gas section, Harry W. Smith, Jr., is the new director of industrial gas publicity of American Gas Association. Mr. Smith's experience includes several years in publicity and advertising work.

Wisconsin Revises Its Home Study

MADISON, WIS.—Dealing with all the important technical phases, the University of Wisconsin home-study course in heating and ventilating has been revised by the Department of Mechanical Engineering, and now includes the more recent advances in engineering knowledge in this field. The purpose of this instruction is to give an opportunity for engineers, architects, draftsmen, contractors, and others to secure a better technical preparation for the work of planning, estimating, and installing heating and ventilating systems. By the home-study plan this instruction can be obtained without interruption of the student's regular occupation.

Increasing use of humidifying systems and thermostatic control, air conditioning requirements of modern heating and ventilating systems, the closer search for heat losses at every point, and the all-around refinement of practice are examples of the present trend.

Other Wisconsin correspondence courses in the same field include heat, heat power engineering, steam boilers, steam engines, refrigeration, and elementary plumbing. The Extension Division here will send catalogs and outlines of courses to men interested in further study in any of these fields of knowledge.

Yaglou Speaks at Detroit Meeting

DETROIT—The regular monthly meeting of the ASHVE Michigan Chapter was held November 7 with 100 members and guests present. The speaker of the evening was Prof. C. P. Yaglou, associate professor of industrial hygiene, Harvard School of Public Health, whose subject was "Health Aspects of Air Conditioning."

Professor Yaglou pointed out that recent tests have proved that relative humidity has little effect on health and comfort so long as it is above 20%.

The talk was discussed by Dr. Henry F. Vaughan, commissioner, department of health, City of Detroit, Dr. H. Lee Simpson of the Wayne County Medical Society, and others.

The meeting was presided over by President F. J. Linsenmeyer. Secretary A. V. Hutchinson was a guest at the meeting.

Domestic Use of Coke Falls Off

WASHINGTON—During 1937, 8,107,518 tons of coke were sold for domestic use and valued at $52,163,279, according to a recent report of the Bureau of Mines. Of this total, 7,807,792 tons were byproduct coke with less than 300,000 tons of beehive coke used for domestic purposes.

The eight million tons used in 1937 compares with 10,021,343 tons in 1936.

Anthracite Conference Set for April

PRIMOS, PA.—The Committee on Arrangements for the second annual anthracite conference to be held at Lehigh University, met at the Anthracite Industries Laboratory here November 23. Prof. Howard Eckfeldt, chairman, announced that the conference would be held on April 28-29, 1939, at Packard Memorial Hall, Lehigh University, Bethlehem, Pa.

The first conference held last spring aroused considerable interest in engineering and merchandising circles, and it was decided to make the meeting an annual affair. Professor Eckfeldt announced that invitations had been sent to a group of prominent authorities to present papers at the next conference.

The committee on arrangements consists of Chairman Eckfeldt; vice-chairman Allen J. Johnson, F. W. Earnest, Jr., J. P. Duffy, J. M. Crosby and Paul C. Mulcey of Anthracite Industries, Inc.; William H. Lesser, Joseph K. Goundie, James R. Ray and C. E. Mengel, anthracite executives; Dr. H. J. Rose of Mellon Institute; and Profs. E. Sinkinson, D. H. Gramley, F. V. Larkin, and Dean B. Stoughton of Lehigh University.

Predicts 15% Jump in Fuel Oil Use

CHICAGO—Moderate increases in volume of both furnace oil consumed this winter and gasoline consumed in 1939 were forecast by the American Petroleum Institute at its 19th annual convention here in November.

A 15% gain in furnace oil and a 4% gain in gasoline demand for the respective periods are tentatively contemplated by the institute's department of statistics.

The number of home-heating burners has almost doubled in the last five years. In the 1933-34 winter there were 920,000 in operation. Indications are the present winter will record an average of 1,690,000 against 1,550,000 last winter. Should the forthcoming heating season be representative of the last five, it should be appreciably colder than last winter—approximately 5% on the basis of degree-days. This leads to the conclusion that approximately 15% more furnace oils will be used in heating homes than the 63,000,000 barrels consumed a year ago.

HEATING & VENTILATING Index for 1938

The annual index for the 12 issues of HEATING & VENTILATING for 1938 is being prepared and will be mailed on request to any subscriber without cost. Address Circulation Department, HEATING & VENTILATING, 148 Lafayette St., New York, N. Y.

Courses Offered in Heating and A.C.

NEW BRUNSWICK, N. J.—Rutgers University is offering, through its extension division, correspondence courses in heating, ventilating, and air conditioning. Offered as separate units are the related subjects heating and ventilating, air conditioning, and oil burner engineering, each complete in itself. With refrigeration, and the preliminary subject, heat, the group presents an excellent coverage of the field.

Of interest is the growing use of home-study courses for supervised groups when a number of employes enrolled in a given course meet on the property of the employer at regular intervals with a company engineer or executive, to discuss the current lesson while carrying on their actual "recitation" by correspondence.

The public utility companies have been the pioneers in this field, beginning with the Rutgers University course, in the manufacture, distribution and utilization of gas for all grades of its operating personnel, and following this up for selected groups with the University's courses in heating, ventilating and air conditioni

Folders describing the courses mentioned may be obtained by addressing University Extension Division, Rutgers University, New Brunswick, N. J.

Chicago WPA Surveys Air Pollution

CHICAGO—An air pollution survey has been begun by WPA for Chicago. An appropriation of $392,000 was granted to conduct a year-long survey and is sponsored by the Department of Smoke Inspection and Abatement.

A brief description of the official authorization follows: Make smoke density readings and calculate quantity produced; collect and analyze samples of solids in atmosphere and in chimney gases, and tabulate the findings; measure concentrations of noxious or harmful gases; record the reception of actinic rays of sunshine; compile bibliographical material on matters related to problems of air pollution, and compile and codify laws and regulations pertaining to air pollution.

King and Queen to Have A.C. Train

OTTAWA, ONT. — The Canadian government has asked Transport Minister Howe to arrange with either the Canadian National or Canadian Pacific Railways to provide a royal train on which King George and Queen Elizabeth will tour Canada during their visit early in the summer of 1939. The Minister of Transport has decided that every one of the 10 coaches in the train must be air conditioned as Their Majesties will spend a considerable part of their time on the train if they visit each of the nine provinces.

Filter Research Begun at Institute

PITTSBURGH—Dr. Edward R. Weidlein, director, Mellon Institute, has announced the establishment of an industrial fellowship in that institution by the American Air Filter Co., Inc., Louisville, Ky. This fellowship will investigate broadly materials of value in the construction of filters for air conditioning systems. It will be the aim to gain through this research new knowledge to effect all possible improvements in the devices manufactured by the donor, and in this work the fellowship will have the direct cooperation of specialists on the staff of the multiple industrial fellowship on air hygiene at the Institute.

Dr. Frank F. Rupert, who has been appointed to the incumbency of the fellowship, has been a member of Mellon Institute since 1913. He received his professional education at the University of Kansas and the Massachusetts Institute of Technology. From 1912 to 1913 he was junior physical chemist in the U. S. Bureau of Mines. Since 1935 Doctor Rupert has been associated with air hygiene.

Westinghouse Shows A. C. Line

SPRINGFIELD, MASS.—Editors of technical and trade publications in the heating, ventilating, and air conditioning field, attended a preview of new Westinghouse air conditioning products here November 17. T. Y. Danley, manager of the air conditioning department of Westinghouse, explained that its new products were expected to result in a better penetration of the available commercial markets and also expected to open up additional possibilities in the residential market.

A feature of the new products was an increase in the upper limits of the capacities of self-contained unit air conditioners, with one of 15 tons exhibited. Also the line of heating products is greatly enlarged, and includes oil burners, boiler-burner units; coal, gas, and oil-fired forced warm air furnaces, and a coal-fired gravity warm air furnace. Special equipment is also available whereby summer cooling may be readily obtained with a unit suitable for adding to a forced warm air furnace installation.

Temple U. Hospital to be Conditioned

PHILADELPHIA—The Temple University Hospital has announced plans for alterations and additions to its plant which include air conditioned operating rooms and soundproof private and semi-private rooms. Addition of a new fifth floor and extensions to the present fourth floor will provide 40 new rooms. In the improvements to buildings and equipment special attention will be given to the operating rooms where it is claimed that more operations are performed each day than in any other Philadelphia hospital.

Rowley to Receive Anderson Medal

NEW YORK—Frank B. Rowley, professor of mechanical engineering and director of the engineering experiment station of the University of Minnesota, has been nominated by the Council of the ASHVE to receive the Society's 1938 award of the F. Paul Anderson medal for "distinguished scientific achievement in heating, ventilating and air conditioning."

Professor Rowley is honored for his outstanding work as teacher and research investigator in the field of heat transmission, insulation, effect of moisture condensation on building materials and dust elimination, on which he has written more than sixty scientific papers and reports.

He will be the third engineer to receive the Anderson medal. Former recipients have been Willis H. Carrier and Dr. A. C. Willard. Formal presentation of the medal will be made at the 45th annual meeting of the society in Pittsburgh, January 25.

Equipment Standards Published

WASHINGTON—Equipment standards have just been published by the Refrigerating Machinery Association. These equipment standards represent the first of a series to result from the broad standardization program which the Association initiated a year or so ago.

The table of contents of the RMA Equipment Standards indicates that Part 1 deals with ammonia equipment under the following headings: enclosed ammonia compressors, vertical open shell and tube ammonia condensers, horizontal closed shell and tube ammonia condensers, horizontal closed ammonia shell and tube brine coolers (flooded), submerged open ammonia brine coolers, ammonia liquid receivers, ammonia mains, steel and wrought iron pipe, and cold storage room insulation.

Part 2 covers the results of the first studies of Freon equipment, with the following section headings: low pressure condensing units (accessories recommended for base units), F-12 condensers (terminal difference), and F-12 water coolers (mean temperature difference).

W. P. Boddington

TORONTO—William P. Boddington, manager of Canadian Powers Regulator Co., Ltd., Toronto, died here November 17 of pneumonia.

He was born in Toronto and worked for Purdy Mansell Co. Ltd. as an apprentice. During the War he held an important position with a firm manufacturing high explosives, at Shawinigan Falls, P.Q.

About twenty years ago, he joined Powers Regulator Co. Ltd., and was shortly placed in charge of its Canadian interests, with headquarters in Toronto. He held this position until his death, and engineered the control systems for many of Canada's largest and most important buildings. He was president of the ASHVE chapter here in 1933-4.

Mr. Boddington is survived by his wife, two sons, two sisters, and two brothers.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF MARCH 3, 1933, OF HEATING & VENTILATING, published monthly at New York, N. Y., for October 1, 1938.

State of New York, County of New York, ss.:

Before me, a Notary Public in and for the State and County aforesaid, personally appeared Edgar A. Becker, who, having been duly sworn according to law, deposes and says that he is the Treasurer of The Industrial Press, publishers of HEATING & VENTILATING and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, The Industrial Press, 140-148 Lafayette St., New York, N. Y.

Editor, C. H. B. Hotchkiss, 140-148 Lafayette St., New York, N. Y.

Managing Editor, Clifford Strock, 140-148 Lafayette St., New York, N. Y.

Business Managers, Robert B. Luchars, 140-148 Lafayette St., New York, N. Y.; Edgar A. Becker, 140-148 Lafayette St., New York, N. Y.; Erik Oberg, 140-148 Lafayette St., New York, N. Y.

2. That the owner is:

The Industrial Press, 140-148 Lafayette St., New York, N. Y.; Erik Oberg, 140-148 Lafayette St., New York, N. Y.; Robert B. Luchars, 140-148 Lafayette St., New York, N. Y.; Edgar A. Becker, 140-148 Lafayette St., New York, N. Y.; Laura A. Brownell, 140-148 Lafayette St., New York, N. Y.; Franklin D. Jones, 140-148 Lafayette St., New York, N. Y.; First National Bank and Trust Co. of Montclair and Robert B. Luchars, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank and Trust Co. of Montclair and Leigh Roy Urban, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank and Trust Co. of Montclair and Kenneth D. Ketchum, Trustees (Beneficiaries unknown), Upper Montclair, N. J.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are:

Laura A. Brownell, 140-148 Lafayette St., New York, N. Y.; John Connolly, 140-148 Lafayette St., New York, N. Y.; Franklin D. Jones, 140-148 Lafayette St., New York, N. Y.; Robert B. Luchars, 140-148 Lafayette St., New York, N. Y.; Louis Pelletier, 140-148 Lafayette St., New York, N. Y.; Elizabeth Y. Urban, 163 Western Drive, Longmeadow, Mass.; Helen L. Ketchum, King St., Cohasset, Mass.; Wilbert A. Mitchell, 28 Harlow Road, Springfield, Vt.; Henry V. Oberg, 28 Spencer Ave., Lancaster, Pa.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

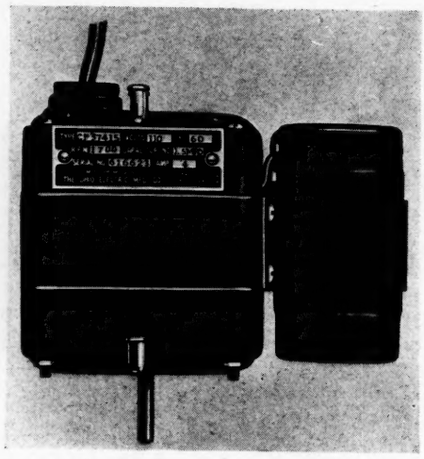
EDGAR A. BECKER, Treasurer.

Sworn to and subscribed before me this 21st day of September, 1938.

CHARLES P. ABEL.

Notary Public, Kings County No. 302; Kings Register No. 9126; N. Y. County No. 197; N. Y. Register No. 9-A-147. My commission expires March 30, 1939.

NEW EQUIPMENT

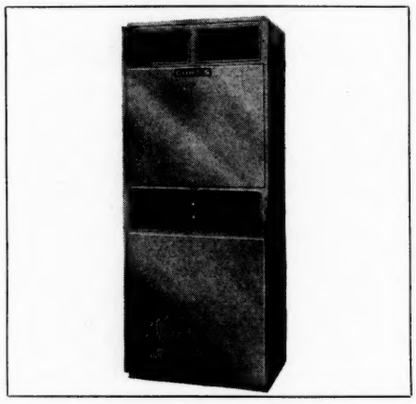


Ohio Split Capacitor Motor

NAME—Ohio split capacitor motor.
PURPOSE—A permanent split capacitor motor for driving small fans, hot water circulators, and other light powered devices.
FEATURES—Motor illustrated operates vertically, shaft down, and is used to circulate the water in hot water heating systems. It is rated 1/100 hp. at 1700 r.p.m. with a start torque of .75 oz. ft. equal to 150% of the full load and a maximum running torque of 2.5 oz. ft. equal to 500% of the full load. At full load the current equals .35 amperes at 110 volts and the efficiency is said to be double that usually expected in small motors. Motor can be built with solid or resilient base to operate horizontally for floor, right or left sidewall, or ceiling mounting, also said to operate vertically with shaft extension up or down. Bearings are oil tight and they are designed for at least 1000 hr. of operation per oiling.
SIZES—Motor is rated from 1/150 to 1/20 hp. depending upon the capacitor employed. Speeds are 850, 1700, or 3400 r.p.m.
MADE BY—*The Ohio Electric Mfg. Co., Cleveland, Ohio.....1*

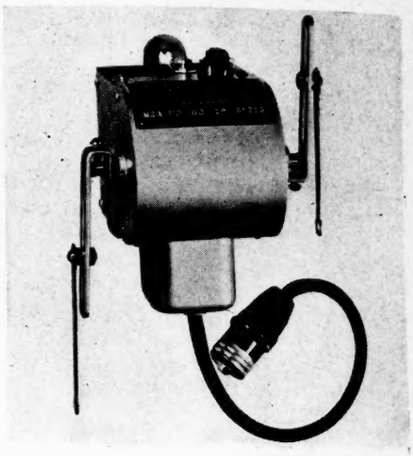
Curtis Air Conditioning Units

NAME—Curtis store and office cooler.
PURPOSE—A packaged air conditioning unit for offices and stores. Unit cools, dehumidifies, circulates and filters.
FEATURES—Cooler is semi-portable in that only water and electrical connections are necessary for installation. It occupies approximately 5½ sq. ft. of floor space. Cabinet is constructed of heavy gage automobile steel with a silver Hammerloid finish or can be furnished with a flat, prime coat ready to take any matching color. Cabinet is lined with a special insulating and sound absorbing material. Operation of the unit is controlled by two dials on the cabinet.
MADE BY—*Curtis Refrigerating Machine Co., St. Louis, Mo.....2*



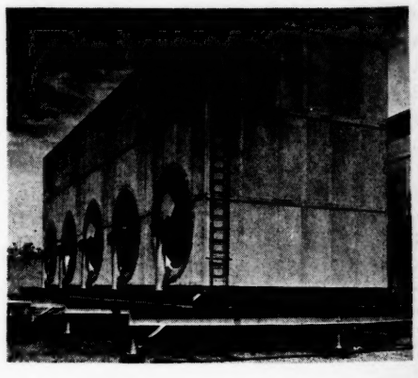
Friez Motor Operator

NAME—Friez motor operator.
PURPOSE—An operator to give effect to the automatic control provided by thermostats and other sensitive instruments without using electrical relays.
FEATURES—Motor operator uses a low voltage which is furnished to the control circuit by a transformer which is supplied with each operator. The operators are provided with auxiliary hand switches giving on-off positions and also with arms which are adjustable in position and which are in turn connected to the draft damper of coal-fired furnaces or boilers, to the duct dampers of air conditioners or warm air systems, to zone dampers or like equipment. Many types are available for three-wire or two-wire applications and with built-in or separately mounted transformers.
LITERATURE AVAILABLE — Friez Bulletin VM.
MADE BY—*Julien P. Friez & Sons. Baltimore, Md. 3*



Lilie-Hoffmann Cooling Tower

NAME—Lilie-Hoffmann cooling tower.
PURPOSE—A fire resistant cooling tower for cooling water for air conditioning condensing units.
FEATURES—This tower has specially designed features to come within the fire restrictions, the shell being made of ⅜-in. transite which is bolted to steel framing installed on the interior of the tower. It is said that no painting is required as the life of the transite is unlimited.
SIZES—From 100 to 10,000 g.p.m.
MADE BY—*Lilie-Hoffmann Cooling Towers, Inc., St. Louis, Mo.....4*



TO OBTAIN FURTHER INFORMATION ON NEW EQUIPMENT

On the list below circle the item number of the equipment in which you are interested, using the number found at the end of each item.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

(This service available only to engineers or executives)

Fill in your name and address, detach and mail to
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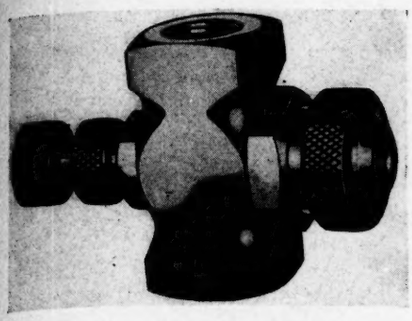
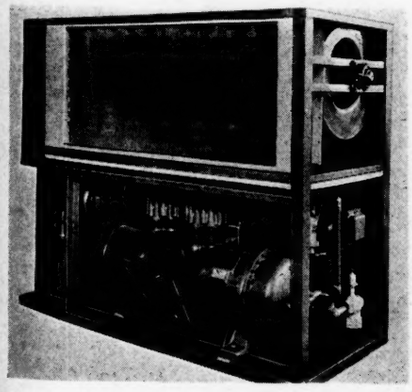


Spraying Atomizing Nozzle

NAME—Pneumatic atomizing nozzle.
PURPOSE—For humidifying or wherever complete atomization is required.
FEATURES—This nozzle is of sturdy construction, accurately machined, and available with externally mixed round spray, internally mixed round spray, or internally mixed flat spray.
SIZES—Compressed air and liquid pipe connections are both ¼ in. female.
MADE BY—*Spraying Systems Co., Chicago, Ill.* 5

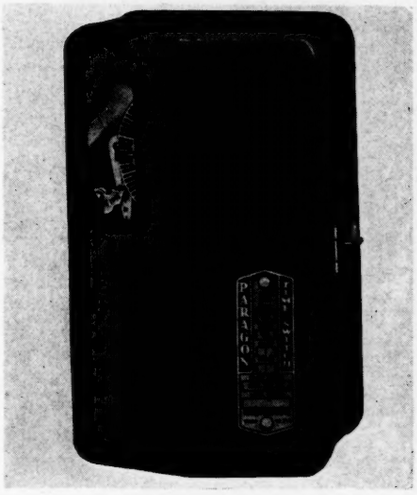
Westinghouse Air Conditioning Units

NAME—Unitaires.
PURPOSE—Self-contained conditioning units for commercial establishments.
FEATURES—Three of these units are of the central systems type and four are for installation within the conditioned space. Units require only power, water, and drain connections and are so designed that they can be carried through a 3-ft. door opening. A hermetically-sealed compressor is incorporated in each unit. Two switches permit maximum flexibility of operation, one controls the entire cooling mechanism and the other the blower motor so that air circulation may be obtained when cooling is not necessary. Provisions have been made for adding heating coils and humidifiers, thereby providing year-round air conditioning. The 15-ton Unitaire is illustrated.
SIZES AND CAPACITIES — Seven sizes with capacities ranging from 1 to 15 tons; in combinations to 30 tons.
MADE BY—*Westinghouse Electric & Mfg. Co., Air Conditioning Div., East Springfield, Mass.* 6



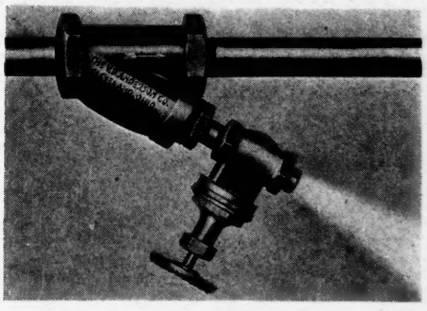
Paragon Time Switch

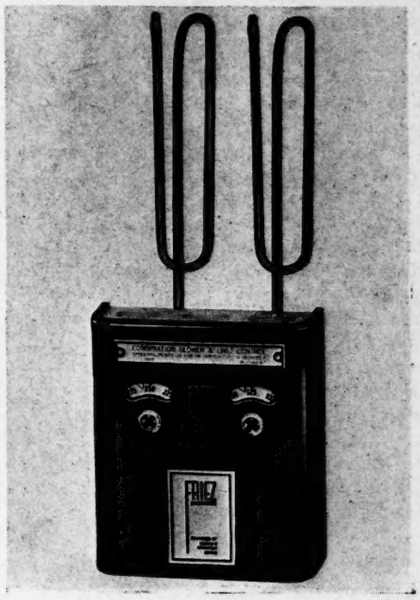
NAME AND MODEL NUMBER—Paragon time switch 300 Series.
PURPOSE—A low-priced time switch.
FEATURES—The switching mechanism consists of a back-and-forth snap-action tripping lever activated by the trippers on the Paragon clear-line dial. This can be mechanically operated without changing the automatic switching sequence. The switch construction is of the instant, snap-action type with heavy silver contactors. Rated capacity is 3000 watts per pole. Through a simplified clock train of five cut gears, floating on two fixed arbors, the speed of the heavy-duty, self-starting 450 r.p.m. synchronous motor is reduced to one dial revolution in 24 hr. Prices are said to be from 20 to 25% below the company's standard line.
LITERATURE AVAILABLE—Bul. 3857
MADE BY—*Paragon Electric Co., Chicago, Ill.* 7



Anderson Strainers

NAME—Self-cleaning strainer.
PURPOSE—For straining gases or liquids with pressures up to 250 lb. at 450F.
FEATURES—Strainers are of alloy cast iron with strainer elements. They may be used on pressures up to 300 lb. where the temperature does not exceed 250F. The manufacturer states that prices on these strainers are low.
SIZES AVAILABLE—¼ to 2 in. pipe sizes.
MADE BY—*The V. D. Anderson Co., Cleveland, Ohio.* 8





Friez Hydraulic Action Controls

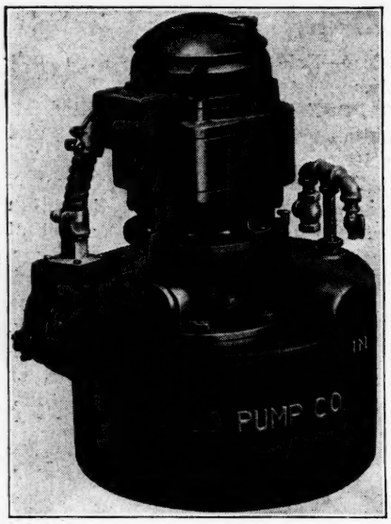
NAME—Friez hydraulic action controls.
PURPOSE—A line of liquid filled hydraulic action controls for heating and ventilating.
FEATURES—These controls are of the solid liquid filled hydraulic action type. The manufacturer states that practically unlimited power gives a new conception of switching mechanism. Controls have a high load carrying capacity (25 amperes at 20 volts, 15 amperes at 240 volts, a.c.) and designed for long service. The fan or warm air limit switch, which is illustrated, is said to have fast sensitivity, adjustable differential and is available in either simple or combined forms, including two speed types for either three or five lead motors. Other controls in this line include warm air limit controls, surface hot water limit controls, immersion hot water limit controls and fan and blower controls.
LITERATURE AVAILABLE — Friez Data Sheet No. 225 and Bulletin LC.
FOR SALE BY—*Julien P. Friez & Sons, Baltimore, Md.*.....9

Autovent Warm Air Booster Fan

NAME—Booster fan.
PURPOSE—For increasing efficiency of warm air gravity systems.
FEATURES—Fan is designed for installation at the base of the cold air return duct at the point where it contacts the furnace. It is equipped with patented deflector plates and is designed to prevent air pockets at any point along the furnace base. The forced air action moves the heated air out of the furnace and distributes it to the rooms in the house.
MADE BY—*Autovent Fan & Blower Co., Chicago, Ill.*.....10

Chicago Condensation Pump

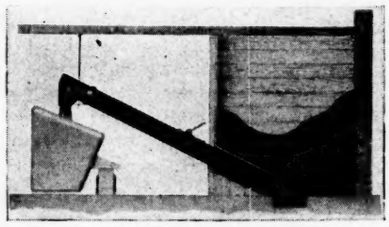
NAME—Chicago condensation pump.
PURPOSE—A small low-cost condensation pump and receiver for heating systems.
FEATURES—The cast iron receiver is small and it is said that it has only a small distance to travel, which the manufacturer states allows the condensation to be returned to the boiler before it has a chance to cool off. The receiver sets on the floor or in a shallow pit with no foundation bolts necessary. Motor is mounted in a vertical position on top of the receiver as a protection against floods. Pump is suspended in the receiver from the motor and the whole assembly, motor and pump, can be lifted out by loosening a few nuts at the top of the receiver. Pump has a bronze casing and rotor and stainless steel shaft. A heavy-duty, enclosed float switch, which is heavy enough to throw the motor



across the line is mounted on the receiver. This float switch is actuated by a seamless copper float inside the receiver.
SIZES—For systems with 500 to 2000 sq. ft. direct radiator surface and 10 to 45 lb. pressure.
MADE BY—*Chicago Pump Co., Chicago, Ill.* *11*

Murray Stoker Loader

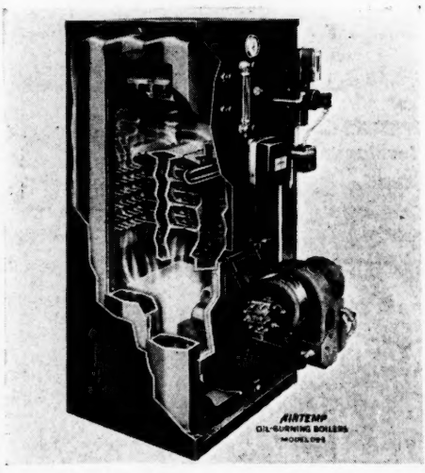
NAME—Automatic loader.
PURPOSE—For automatically filling stoker hoppers.
FEATURES—Loader has a capacity up to 10 tons of coal per hour and can be adjusted to meet the room requirements. The length of the loader is determined by the distance from the coal pile to the stoker. Loader is equipped with a 1½-hp. motor and uses electricity only during the few minutes which it takes to fill the stoker hopper. The model illustrated is suspended from the ceiling but it also may be supported by a stand from the floor.



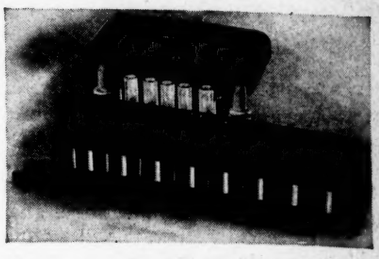
Loaders can be furnished for right- or left-hand operation.
MADE BY—*D. J. Murray Mfg. Co., Wausau, Wis.* *12*

Airtemp Boilers

NAME—Airtemp oil-burning and gas-burning boilers.
PURPOSE—For supplying steam or hot water using oil or gas as a fuel.
FEATURES — Boilers are designed especially for burning oil or gas and are furnished complete with oil burner or gas burner. The boiler heating section is constructed of cast iron with finned elements or baffles. The fin elements in the flue gas passages are arranged in staggered rows. A water line 44 in. from the floor makes the boilers suitable for applications where head room is a prime factor. Standard accessories furnished with the boiler include steam gage, safety valve, gage glass and fittings, and tri-cocks on the steam boilers; combination altitude gage and thermometer on the water boilers. On the oil boilers the controls furnished as standard equipment include the primary control and safety limit control on the steam boilers and a water limit control on the water boilers. On the gas-fired boilers a magnetic gas valve, gas regulator and control and thermostatic pilot are provided. Built-in water heater for domestic hot water is also provided. The oil boiler has incorporated in it a combustion chamber of chrome rustless steel. This chamber is suspended within the firebox and permits complete circulation of combustion gases around the entire chamber. Illustration shows one of the Airtemp oil-burning boilers.



SIZES AND CAPACITIES—Oil boiler burners in six sizes with capacities ranging from 96,000 to 408,000 B.t.u. per hr. at the header. The gas boilers are available in four sizes with capacities ranging from 96,000 to 252,000 B.t.u. per hr. at the header.
MADE BY—*Airtemp, Inc., Dayton, Ohio.* *13*

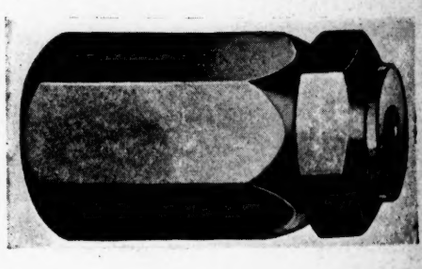


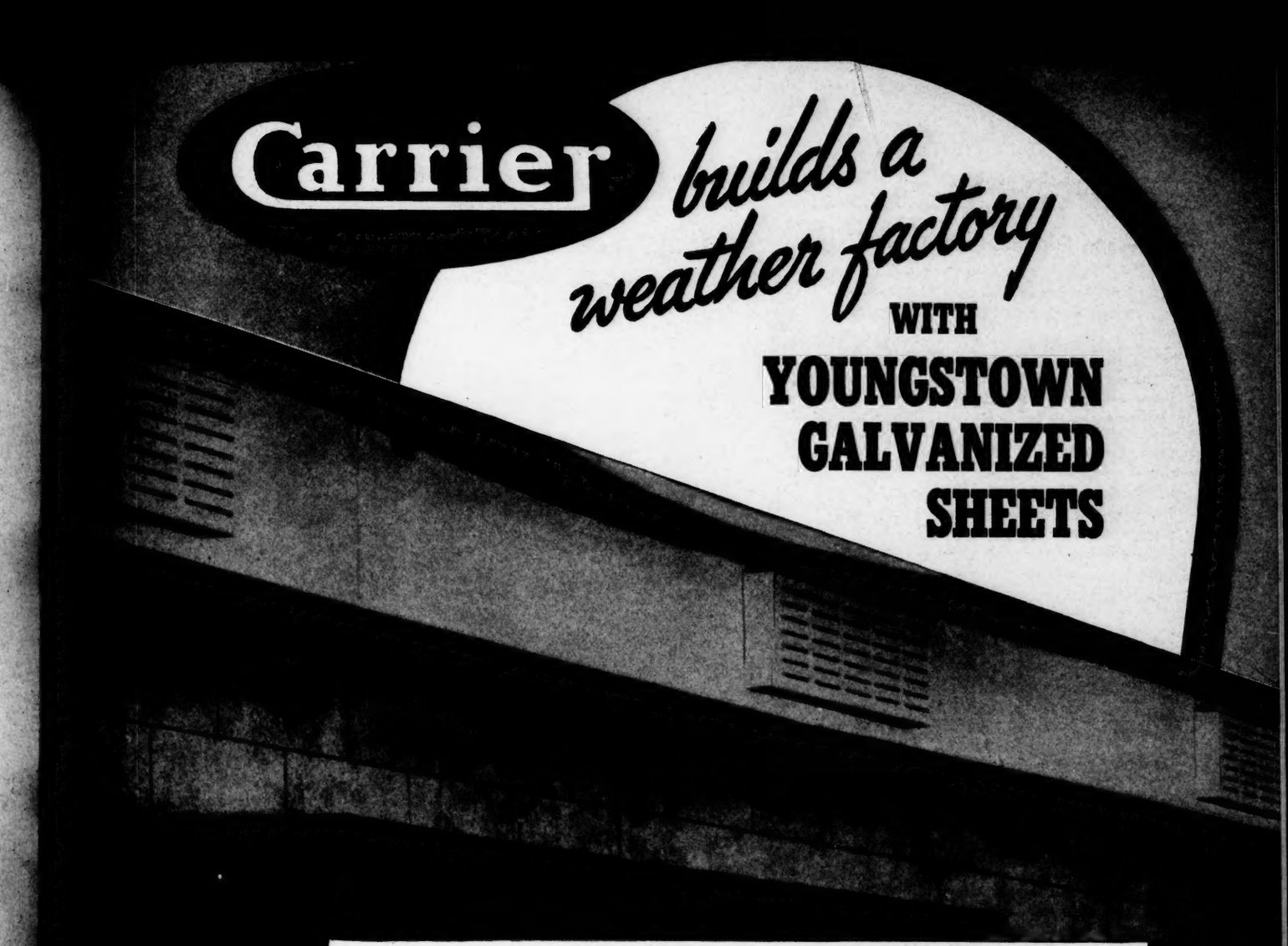
Taylor pH Slide Comparator

NAME—Taylor pH slide comparator.
PURPOSE—A slide comparator for the colorimetric determination of pH, chlorine and phosphates.
FEATURES—The comparator consists of a slide and a base. Each slide contains nine color standards alternating with ampoules of distilled water. The base contains two vials of indicator solution, with 0.5cc pipettes, five 5cc test tubes and a piece of etched glass in a special compartment. Determinations are made by filling three of the test tubes with the test sample, adding 0.5cc of indicator solution to the middle one, placing the slide on the base and moving it back and forth until the test sample matches one of the color standards. The pH, chlorine or phosphate value is then read off directly from the values on the slide. One base can be used with any number of color standard slides.
MADE BY—*W. A. Taylor & Co., Baltimore, Md.* *14*

Spray Nozzles

NAME—Atomizing nozzles.
PURPOSE—For humidifying air.
FEATURES—Spray is the hollow cone type with uniform distribution and atomization. Nozzle is accurately machined and standard stock construction is brass with stainless steel inserts; other metals can be specified.
SIZES AND CAPACITIES—¼ in. male or female pipe connection with or without strainer. Capacities range from 1 to 14 g.p.m. at 40 lb. pressure.
MADE BY—*Spraying Systems Co., Chicago, Ill.* *15*





Carrier builds a weather factory WITH YOUNGSTOWN GALVANIZED SHEETS

★At the Hammel Department Store in Mobile, Alabama, Carrier Corporation manufactures cool sales-building weather and delivers it in ducts fabricated from Youngstown Sheets.

To a sheet metal man this installation is noteworthy. Even though the ducts are in plain sight in the store, there is no plaster over them -- just a coat of paint -- yet seams are true and edges even, corners straight, neat and tidy. Good workmanship and material need no camouflage.

GALVANIZED TRADE MARK YOUNGSTOWN SHEETS

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon and Alloy Steels

General Offices - YOUNGSTOWN, OHIO

Sheets - Plates - Pipe and Tubular Products - Conduit - Tin Plate - Bars - Rods - Wire - Nails - Unions - Tie Plates and Spikes.

Degree-Day Figures for October, 1938

HEATING & VENTILATING continues its eleventh year of publishing degree-day data for various large cities

	Albany, N. Y.	Atlanta, Ga.	Baltimore, Md.	Birmingham, Ala.	Boston, Mass.	Buffalo, N. Y.	Burlington, Vt.
Degree-days for October, 1938.....	387	80	189	64	295	367	485
Degree-days for Sept. 1 to Oct. 31, 1938	597	97	225	73	409	548	774
Degree-days, Sept. 1 to Oct. 31, 1937..	599	247	344	193	515	709	771
Degree-days, Sept. 1 to Oct. 31, Normal	519	96	223	0	411	494	625

	Cheyenne, Wyo.	Chicago, Ill.	Cincinnati, Ohio	Cleveland, Ohio	Columbus, Ohio	Denver, Colo.	Des Moines, Iowa
Degree-days for October, 1938.....	472	235	228	289	260	288	186
Degree-days for Sept. 1 to Oct. 31, 1938	625	324	286	380	317	341	256
Degree-days, Sept. 1 to Oct. 31, 1937..	668	563	479	587	521	417	513
Degree-days, Sept. 1 to Oct. 31, Normal	845	356	248	393	313	500	357

	Detroit, Mich.	Dodge City, Kan.	Duluth, Minn.	El Paso, Tex.	Erie, Pa.	Evansville, Ind.	Fort Wayne, Ind.
Degree-days for October, 1938.....	329	150	482	36	297	124	285
Degree-days for Sept. 1 to Oct. 31, 1938	468	167	709	36	421	160	367
Degree-days, Sept. 1 to Oct. 31, 1937..	697	299	1027	41	634	346	628
Degree-days, Sept. 1 to Oct. 31, Normal	442	276	881	40	414	155	347

	Fort Worth, Tex.	Grand Rapids, Mich.	Green Bay, Wis.	Harrisburg, Pa.	Hartford, Conn.	Indianapolis, Ind.	Ithaca, N. Y.
Degree-days for October, 1938.....	35	283	329	265	271	221	376
Degree-days for Sept. 1 to Oct. 31, 1938	35	412	495	352	397	286	600
Degree-days, Sept. 1 to Oct. 31, 1937..	79	670	796	497	577	507	743
Degree-days, Sept. 1 to Oct. 31, Normal	0	476	637	329	392	298	539

	Kansas City, Mo.	Knoxville, Tenn.	La Crosse, Wis.	Lansing, Mich.	Lincoln, Neb.	Little Rock, Ark.	Los Angeles, Calif.
Degree-days for October, 1938.....	121	131	294	365	147	69	27
Degree-days for Sept. 1 to Oct. 31, 1938	161	153	413	546	198	75	27
Degree-days, Sept. 1 to Oct. 31, 1937..	325	305	696	796	416	198	19
Degree-days, Sept. 1 to Oct. 31, Normal	214	183	558	595	316	47	0

	Louisville, Ky.	Madison, Wis.	Memphis, Tenn.	Milwaukee, Wis.	Minneapolis, Minn.	Nashville, Tenn.	New Haven, Conn.
Degree-days for October, 1938.....	172	303	71	290	323	107	247
Degree-days for Sept. 1 to Oct. 31, 1938	211	432	83	403	442	131	361
Degree-days, Sept. 1 to Oct. 31, 1937..	391	694	223	650	737	294	523
Degree-days, Sept. 1 to Oct. 31, Normal	186	546	62	534	574	136	399

	New Orleans, La.	New York, N. Y.	Norfolk, Va.	Oklahoma City, Okla.	Omaha, Neb.	Peoria, Ill.	Philadelphia, Pa.
Degree-days for October, 1938.....	7	218	150	78	165	206	193
Degree-days for Sept. 1 to Oct. 31, 1938	7	271	161	87	224	287	237
Degree-days, Sept. 1 to Oct. 31, 1937..	41	419	225	186	458	542	392
Degree-days, Sept. 1 to Oct. 31, Normal	0	276	99	105	329	384	242

	Pittsburgh, Pa.	Portland, Me.	Portland, Oreg.	Providence, R. I.	Reading, Pa.	Reno, Nev.	Richmond, Va.
Degree-days for October, 1938.....	269	371	240	270	244	444	198
Degree-days for Sept. 1 to Oct. 31, 1938	335	566	259	379	333	493	229
Degree-days, Sept. 1 to Oct. 31, 1937..	544	661	275	544	459	412	356
Degree-days, Sept. 1 to Oct. 31, Normal	313	563	437	411	344	597	158

	Rochester, N. Y.	St. Louis, Mo.	Salt Lake City, Utah	San Francisco, Calif.	Scranton, Pa.	Seattle, Wash.	Spokane, Wash.
Degree-days for October, 1938.....	348	116	305	118	335	310	430
Degree-days for Sept. 1 to Oct. 31, 1938	524	152	312	244	492	374	486
Degree-days, Sept. 1 to Oct. 31, 1937..	707	336	333	226	632	394	524
Degree-days, Sept. 1 to Oct. 31, Normal	503	205	406	260	457	595	707

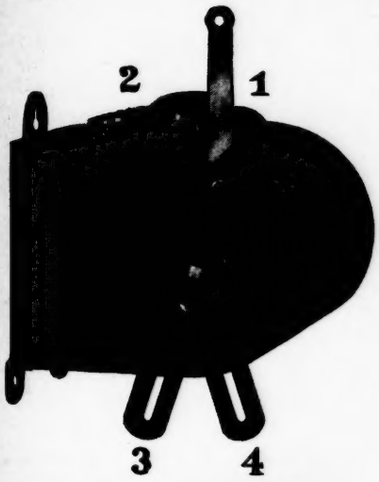
	Springfield, Ill.	Syracuse, N. Y.	Toledo, Ohio	Trenton, N. J.	Utica, N. Y.	Washington, D. C.	Wichita, Kan.
Degree-days for October, 1938.....	161	349	300	241	372	215	98
Degree-days for Sept. 1 to Oct. 31, 1938	207	548	401	315	605	258	124
Degree-days, Sept. 1 to Oct. 31, 1937..	438	658	641	459	685	391	279
Degree-days, Sept. 1 to Oct. 31, Normal	282	521	378	242	612	251	192

Methods of applying the degree-day in connection with the operation of heating plants or for the prediction of fuel consumption of heating plants are described fully in the new enlarged edition of the DEGREE-DAY HANDBOOK, published by HEATING & VENTILATING, 148 Lafayette Street, New York, price $3. Degree-days as given above for a "normal" month or season are based on averages for a long period of years, ending about 1922. Averages covering different periods will disagree with the above figures slightly.

A NEW DEVELOPMENT

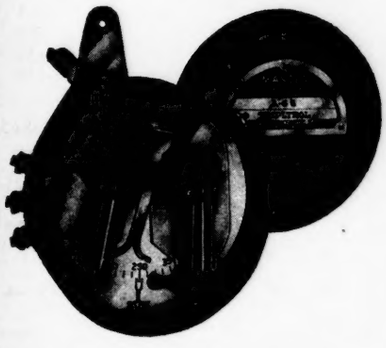
in controls for hand fired furnaces with circulating blowers

Master Tripltrol



The main feature of this system lies in the flexibility of the Master damper motor which will take any one of three positions when the room thermostat calls for heat. In one position the draft only is on, in another the draft and fan, and in the third the fan only.

BOTH SUMMER AND WINTER CONTROL



Built especially for hand-fired furnaces with blowers, this control is also applicable to hot water heating systems with circulators. The Tripltrol System recognizes the need of functioning from three definite temperatures encountered in the bonnet of a furnace. Through cooperation between room thermostat and bonnet control it coordinates the action of the circulating blower and draft dampers to perfectly meet every condition.

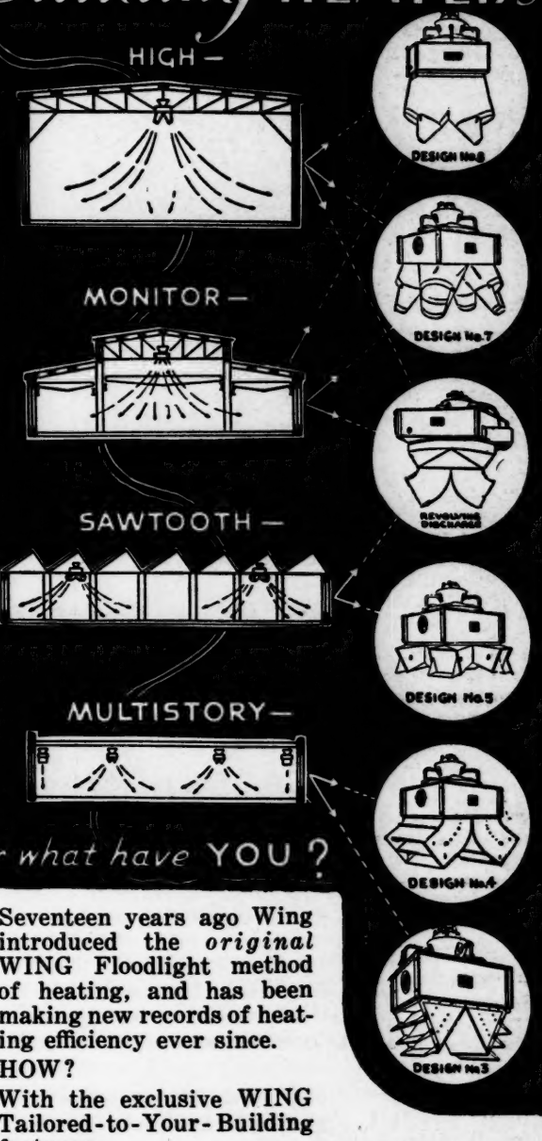
For full information write for Bulletin 900

WHITE MFG. CO.

2364 University Ave. St. Paul, Minn.

MASTER HEAT REGULATOR

Tailored-To-Your-Building HEATERS!



or what have YOU ?

Seventeen years ago Wing introduced the *original* WING Floodlight method of heating, and has been making new records of heating efficiency ever since.

HOW?

With the exclusive WING Tailored-to-Your-Building features.

The WING Featherweight Unit Heater is the *Only* heater that offers discharge outlets specifically designed to YOUR particular building conditions, and assures you the most effective heat projection, distribution, and diffusion at lowest cost.

Write today for Bulletin No. H-6A

L. J. Wing Mfg. Co.

(The Pioneer of Ceiling-Suspended and Lightweight Unit Heaters)

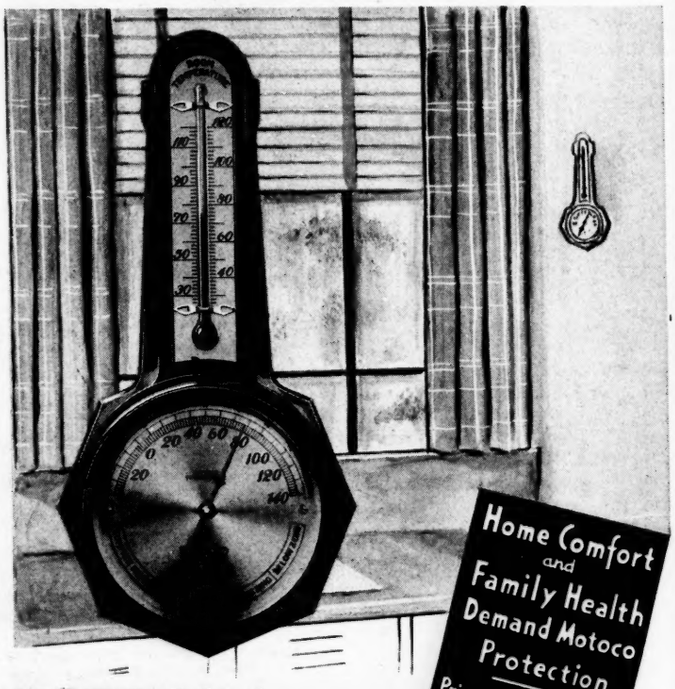
158 W. 14th St., NEW YORK, N. Y.

Wing *Featherweight* UNIT HEATERS

Floodlights of Heat

The MOTOCO

INDOOR and OUTDOOR TEMPERATURE at a GLANCE —



MOTOCO for your Home and Office

MOTOCO located at a convenient place in your home or office not only indicates both the Indoor and Outdoor temperatures at a glance, but also points out the difference between the two. Consider what this means, because of its effect on both your comfort and your health, as the difference in the Indoor and Outdoor temperatures is of vital importance.

Indoor temperature to be healthful must be maintained within definite limits. A sudden rise or fall in outside temperature has a direct influence on home heating and ventilation, which cannot be properly regulated without an exact knowledge of the outside temperature changes. MOTOCO keeps you informed at all hours of the day or night.

Literature will be forwarded upon request.

MOTOCO has an artistic silver finish dial and bevel crystal. It may be obtained in the following colors: maroon, walnut, black, green and ivory.

THE ELECTRIC AUTO-LITE COMPANY
MOTO METER GAUGE & EQUIPMENT DIV.
CHRYSLER BUILDING · NEW YORK CITY, N.Y.

Answers to Questions on Page 47

1. A halide torch is used for locating Freon leaks, so that (5) is correct.

2. In 1845, so that (3) is correct.

3. Henri Regnault, so that (4) is correct.

4. Insolation is the heat received from the sun. (3) is correct.

5. The day is so much longer at the North Pole at the summer solstice than at any other place that in spite of the lower intensity the total heat received is at a maximum there. (1) is correct.

Answer to Problem on Page 47

Let X = distance from cow to nearest end of bridge.

Then $4X + X + 8 + X + 8 - 1\,2/3 = 4 \quad (8 + 8 + X - 1\,2/3)$

Whence $X = 21\ ½$

Therefore, $21\ ½ + 8$ = distance to center of bridge, and total length of bridge = 59 ft.

COMING EVENTS

DECEMBER 5-10, 1938. 13th National Exposition of Power and Mechanical Engineering, Grand Central Palace, New York.

DECEMBER 6-8, 1938. 34th Annual Meeting, American Society of Refrigerating Engineers, Hotel Commodore, New York. ASRE Headquarters, 37 West 39th St., New York.

DECEMBER 12-14, 1938. Convention and 25th Anniversary, National Warm Air Heating and Air Conditioning Association, Netherland-Plaza Hotel, Cincinnati, Ohio. Allen W. Williams, Managing Director, 50 W. Broad St., Columbus, Ohio.

JANUARY 23-26, 1939. 45th Annual Meeting, American Society of Heating and Ventilating Engineers, William Penn Hotel, Pittsburgh, Pa. ASHVE Headquarters, 51 Madison Ave., New York.

APRIL 28-29, 1939. Second Annual Anthracite Conference, Packard Memorial Hall, Lehigh University, Bethlehem, Pa. Chairman, Committee on Arrangements, Prof. Howard Eckfeldt, Lehigh University.

MAY 22-23, 1939. 26th Spring Meeting, American Society of Refrigerating Engineers, Hotel Hershey, Hershey, Pa.

MAY 24-26, 1939. Annual Convention, Association of Gas Appliance and Equipment Manufacturers, Hotel Roosevelt, New York, Association Headquarters, 60 East 42nd St., New York.

MAY 31-JUNE 2, 1939. 50th Annual Convention, Heating, Piping and Air Conditioning Contractors National Association, Drake Hotel, Chicago, Ill. Association headquarters, Room 1401, 1250 Sixth Ave., New York.

JUNE 13-16, 1939. 33rd Annual Convention, Smoke Prevention Association, Hotel Schroeder, Milwaukee, Wis. A Fuel Burning and Air Pollution Exhibition at the Milwaukee Auditorium will be held under the auspices of the Association. C. D. Behan, Publicity Director, SPA, City Hall Sq. Bldg., Chicago.

JUNE 27-30, 1939. 30th Annual Convention and Equipment Exhibit, National District Heating Association, Hotel Pennsylvania, New York. Wm. H. Sanford, Secretary-Treasurer, NDHA, 1317 Spruce St., Philadelphia, Pa.

JULY 2-5, 1939. 45th Semi-Annual Meeting American Society of Heating and Ventilating Engineers, Grand Hotel, Mackinac Island, Mich.

JANUARY 22-26, 1940. 46th Annual Meeting, American Society of Heating and Ventilating Engineers, Cleveland, Ohio. To be held in conjunction with the 6th International Heating and Ventilating Exposition at the Cleveland Public Hall.

JANUARY 23-25, 1940. 35th Annual Meeting, American Society of Refrigerating Engineers, Hotel Cleveland, Cleveland, Ohio.

SUMMER DEGREE-HOURS (ABOVE 85F)*
OCTOBER, 1938

City	October, 1938	October, 1937	Year 1938 to Oct. 31	Year 1937 to Oct. 31
Baltimore	16	0	1394	1543
Birmingham	72	14	2368	2803
Bismarck	2	0	1035	1660
Boston	4	0	358	704
Buffalo	0	0	17	27
Chicago	0	0	337	652
Cincinnati	1	1	705	1033
Cleveland	0	0	142	165
Columbus	0	0	969	854
Des Moines	68	19	2523	2507
Detroit	0	0	340	512
Fort Wayne	0	0	353	542
Grand Rapids	0	0	293	980
Houston	212	77	3290	4034
Indianapolis	1	1	672	834
Kansas City	205	41	5101	5016
Memphis	64	4	3066	2061
Milwaukee	0	0	233	684
Minneapolis	1	0	541	1835
New Orleans	84	39	3121	2659
New York	7	0	214	500
Philadelphia	11	0	591	1003
Pittsburgh	0	0	365	538
Portland, Oreg.	0	0	589	208
Richmond, Va.	5	0	943	1339
St. Louis	76	20	3028	2388
San Diego	0	0	3	14
San Francisco	0	3	4	12
Savannah	4	60	2967	2320
Toledo	0	1	445	581
Washington	2	0	1194	1279

*Based on data made available through the cooperation of the U. S. Weather Bureau.

WITH THE MANUFACTURERS

Henry M. Reed

American Radiator and Standard Sanitary Corp., New York, on November 17 elected *Henry M. Reed* chairman of the board and president. Mr. Reed, who has been president of the Standard Sanitary Manufacturing Co., will continue in this position and in addition will be chairman of the board of American Radiator Company.

Anthracite Industries, Inc., New York, has named *Oscar F. Ostby* assistant to the president. Mr. Ostby was former president of Independent Anthracite Coals, Inc., and at one time vice-president of Electric Furnace-Man, Inc. Mr. Ostby was one of the organizers of the Anthracite Club of New York.

Combustion Engineering Co., Inc., New York, has opened a branch office in Birmingham, Ala., under the direction of *J. B. Emory*, district manager, assisted by *W. E. Johnson*. The branch office is located at 516 Martin Building.

The Emerson Electric Mfg. Co., St. Louis, Mo., has appointed *George Reindel, Jr.*, district manager of its Detroit office, located at 316 Stormfeltz-Loveley Bldg.

SANITARIUM ENJOYS BALANCED HEATING AT MODEST COST

Webster Moderator System Gives New Saratoga County Hospital Complete Heating Comfort

COMFORT IN COLDEST WEATHER

Open Window Ventilation, When Desired, Does Not Affect Economy or Comfort

"IDEAL" FOR HOSPITAL NEEDS

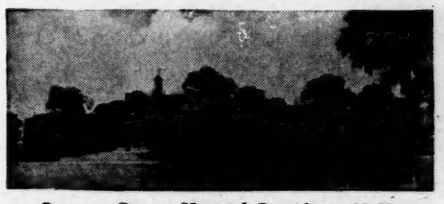
Providence, N. Y.—Built in 1937, the Saratoga County Hospital, a modern sanitarium for the treatment of tuberculosis, has secured comfortable, economical heating service with a Webster Moderator System of Steam Heating.

Hospital officials selected the Webster Moderator System because of its record of effectiveness in many similar installations. One season's experience convinced them of the soundness of their judgment.

Dr. A. R. Dimock, the Doctor-in-Charge, reports that even temperature and equal distribution of heat have been maintained during the severest winter weather.

"For heating comfort and minimum consumption of steam, the Webster Moderator System is ideal for our needs," Dr. Dimock said.

With the Webster Moderator System, heat is delivered continuously to all radiators. There is no on-and-off heating with its alternate "cold 70" and overheating. Moderate open-window ventilation, when desired, does not affect either the economy or comfort of the installation.



Saratoga County Hospital, Providence, N. Y.

"Control-by-the-Weather" is provided by an Outdoor Thermostat, which automatically adjusts the basic rate of steam delivery with every change in weather or wind direction. A manual Variator allows the operator to vary the steam supply to meet special conditions.

All of the installation work was done by Cohn & Kramer, well-known heating firm of Albany. There is a total of 14,000 sq. ft. of installed direct radiation. The Saratoga County Hospital was designed by William H. Vaughan, Saratoga Springs architect.

If you are interested in heating *new* buildings, or in improved heating service and lower heating cost in your present building, address

WEBSTER MODERATOR CONTROL "Control by the weather"

1888 WARREN WEBSTER & CO., CAMDEN, N. J. 1938

Pioneers of Modern Steam Heating

50 YEARS OF HEATING PROGRESS

Representatives in 60 principal U. S. Cities

MOISTURE BARRED

IN a Ric-wiL Underground Steam System, moisture is effectively BARRED. By the cemented Loc-liP side joint and interlocking bell end joint, and by the use of incomparable Dry-paC Waterproof Asbestos Insulation, steam efficiency is shut IN—and water shut OUT. Deterioration is halted—Ric-wiL Conduit gives permanent protection to your lines. Don't gamble—insist on a Ric-wiL job—the conduit with a successful RECORD of nearly 30 years!

Prevent leakage and loss in your steam lines, keep them tight, dry and 90%+ efficient with a Ric-wiL Tile or Cast Iron System. Ric-wiL service is complete from design to installation and tests, and is nationwide. On any subsoil steam conveyance problem—undersupply, fuel waste, loss in transit—Ric-wiL can give you effective assistance. Write for complete catalog and test data.

The RIC-WIL Co., Union Commerce Bldg., Cleveland, Ohio

New York **Chicago**

Agents in principal cities

● **Dry-paC is pure, unadulterated long fibre asbestos, needing no binder. Absolutely OPEN to inspection during installation.**

RIC-WIL Type F Conduit

REGISTERED IN U. S. PATENT OFFICE

RIC-WIL

CONDUIT SYSTEMS FOR UNDERGROUND STEAM PIPES

Electrol Inc., New York, has named *Stanley H. Brown,* vice-president and general sales manager, as treasurer of the company. The following dealers have been appointed: *Niagara Oil Burner Corp.; Geo. J. Fritz,* Beacon, N. Y.; *Household Fuel Corp.,* Hartford, Conn.; *E. L. Kelly,* Stamford, N. Y.; *Petroleum Service Co., Inc.,* Providence, R. I.

Iron Fireman Mfg. Co., has doubled its production floor space with the purchase of a second Cleveland plant, the former Lang Body plant, almost adjoining the present Iron Fireman factory.

Jones & Laughlin Steel Corp., Pittsburgh, has appointed *A. J. Hazlett* manager of the strip-sheet sales department, succeeding *William Miller* who was named district manager of the Detroit office.

Kisco Co., Inc., St. Louis, Mo., has moved to its new offices and factory at 3732-40 *Chouteau Ave.* This is the firm's sixth move to larger quarters in 10 years.

Jas. P. Marsh Corp., Chicago, has appointed the following representatives: *John A. Dodd,* 101 Marietta Bldg., Atlanta, Ga.; *Eshelman and Potter,* Martin Bldg., Birmingham, Ala.; *P. F. Miremont,* 3140 Gentilly Ave., New Orleans, La.; *New Mexico Heating Specialty Agency,* 319 N. Sixth St., Albuquerque, N. M.; *R. G. Titherington,* 805 Howard Ave., New Orleans, La.; *Sanderson-Smith Co.,* 1710 Walnut St., Philadelphia; *Laurence Trant & Co.,* 113 Main St., Norfolk, Va.

Penn Electric Switch Co., Goshen, Ind., announces that *D. J. Bower,* who represents the company in Oklahoma, Texas, Arkansas, and Louisiana, is now located at 2211 Commerce St., Dallas, Tex.

A. W. Barr has been named manager of Penn's Boston office succeeding *A. L. Rubel,* who has been transferred to take charge of the Philadelphia branch. *D. A. Coon,* former Philadelphia branch manager, has been placed in charge of the new branch opened in St. Louis.

The Standard Lime and Stone Co., Baltimore, Md., has appointed the following distributors: *The Elliott-Lewis Co.,* 2518 N. Broad St., Philadelphia; *Ralph R. Reeder & Sons, Inc.,* 24th St. and Winthrop Ave., Indianapolis; *Maintenance Products Co.,* 531 S. High St., Columbus, Ohio; *H. C. Fonde & Sons,* 4204 Kingston Pike, Knoxville, Tenn.; *L. D. Wingfield—Hatcher Coal Co.,* 1500 Magnolia St., Richmond, Va.

Taylor Instrument Companies, Rochester, N. Y., announces that *Herbert J. Winn,* retiring president, becomes chairman of the board and is succeeded in the presidency by *Lewis B. Swift,* former vice-president in charge of engineering and research. *Karl H. Hubbard* has been appointed chief engineer, in charge of engineering research and design, and *Dr. H. L. Mason* will succeed him as head of the research division. Other officers include: vice-presidents, *P. Richard Jameson, Henry W. Kimmel,* and *Fred K. Taylor;* treasurer, *Herbert J. Noble;* secretary, *Henry W. Kimmel;* assistant secretary, *George H. Taylor.*

L. J. Wing Mfg. Co., New York, has appointed *H. E. Birkholz,* Gerke Bldg., Cincinnati, in charge of sales in the Cincinnati territory.

York Ice Machinery Corp., York, Pa., sponsored the annual meeting of the company's 25-Year Club November 10. *W. S. Shipley,* president of the corporation, was the main speaker. All club members have served the company 25 years or more and comprise 10% of the company's employes.

NEW TRADE LITERATURE

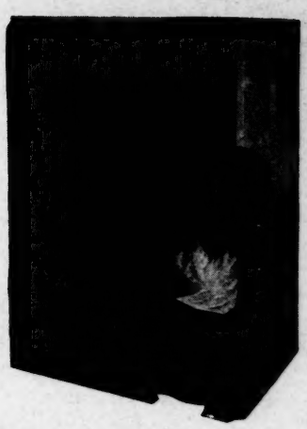
Heating Pumps and Accessories by Dunham. A standard-size, 36-page booklet in color and with many photographs and drawings. This booklet is unique in that it is so obviously prepared to take into account the point of view of the buyer of pumps. The several types of pumps offered are identified as being for large projects, for average projects, or for small projects. The principle of all of them is carefully illustrated and explained after which the reason why each pump should be applied as recommended is carefully described. Characteristic curves and testing methods are shown together with a point-by-point description of the parts which go to make up this line of pumps. An especially attractive feature is the presentation of color drawings with the operating parts cut away to show function and arrangement of the working parts. Control applications are illustrated by the unusual method of showing black on white outline drawings of the pumps against a blue background. Suitable specifications are included; installation details; capacities and dimensions; and methods of arriving at the discharge pressure against which the pumps must operate, as an aid in selecting pumps of sufficient capacity. Methods of operation and maintenance are also included together with various drawings showing how these pumps are used on process applications. C. A. DUNHAM CO., CHICAGO, ILL. 16

Bacteria Control. A 16-page, pocket-size booklet entitled "Bacteria Control in Air Conditioning." Booklet reviews new developments in methods and materials for use in air conditioning systems where the air is washed by a recirculating water supply. It discusses control of bacterial growths, protection of equipment against corrosion, and prevention of slime and algae deposits in the system. Avoidance of water scale formation is also mentioned. Information is also included on such problems as controlling odors, avoiding clogged spray heads and return lines, treating humidifying systems, cleaning air filters, and cleaning evaporative and shell and tube type condensers. OAKITE PRODUCTS, INC., NEW YORK. 17

Condensate Meters. A standard-size, four-page revised bulletin, No. 35-80A, on the Adsco rotary condensation meter. Bulletin illustrates and describes the meter, gives details of construction, operation, installation diagrams, typical installation photographs and a partial list of users in various fields. AMERICAN DISTRICT STEAM CO,. NORTH TONAWANDA, N. Y. 18

Heating Surface. A standard-size, 52-page catalog, No. 574, giving engineering data on Vento heaters, including a large amount of application data such as a method of estimating Vento heaters, constants for calculating heat transmission, sizes of supply and return pipes, velocities of air through heaters, properties of air and ratings and free areas of heaters. Catalog also gives tables of the final temperatures and condensations of various sections. The last part of the catalog is devoted to sketches showing how Vento heaters should be installed. AMERICAN RADIATOR CO., NEW YORK.....19

Insulation. A standard-size, 26-page catalog describing the American Hair & Felt Company's complete line of hair felt products for thermal insulation, sound absorption, and general cushioning. Gives information on the various types of insulation and soundproofing, shows the heat transmission coefficients and lists specifications. AMERICAN HAIR & FELT CO., CHICAGO..... 20



Hank

Sez—
As How We Burnham Folks Don't Climb In No Window When You Ain't Lookin

Now and again—once every 5 years or so—some feller what has his eye teeth cut, asks us where we stand on standing back of dealers.

Meaning, do we help him make sales with our left hand, and hinder him making 'em with our right?

Well, whatever he means, there's only one meaning to the way our Burnham folks help. They help you dealers with *both* hands.

All our boilers, radiators and what have you, are distributed through wholesalers. No climbing in any window to make a sale behind your back when you're not looking.

That's the way we been doing business for close to half a century and it's too late now to begin doing it any other way and keep friends with you, good friends.

So you can leave any window unlocked you want ter and feel safe as if in church.

Hank Hindle

BURNHAM BOILER CORPORATION
Distributed Through Wholesalers
IRVINGTON, N. Y. ZANESVILLE, OHIO
Branch Offices in All Principal Cities
Export Department: 50 Church St., N. Y. City

Burnham Boiler

Industrial Heating Equipment. A standard-size, spirally-bound catalog, illustrating and describing the various pieces of equipment of the Industrial Gas Engineering Co. Includes information on thermo insulated high temperature exhausters, gas-fired heating units and air draw furnaces. INDUSTRIAL GAS ENGINEERING CO., INC., CHICAGO, ILL. 21

Registers. A standard-size, 72-page Register Book, No. 39, illustrating and listing registers, intakes and grilles for gravity heating and air conditioning systems. THE AUER REGISTER CO., CLEVELAND, OHIO. 22

Registers. A standard-size, 48-page catalog, No. 6, illustrating and describing the complete line of registers and grilles offered by the Register & Grille Mfg. Co. REGISTER & GRILLE MFG. CO., INC., BROOKLYN, N. Y.. 23

Stokers. A standard-size, attractive, 18-page bulletin, No. 140, on the Detroit multiple retort stoker. This stoker is designed for large boilers and high capacities. Gives information and many illustrations on the construction and features of the stoker, as well as a number of illustrations showing installations in various types of boilers. DETROIT STOKER CO., DETROIT, MICH..... 24

Unit Heaters. A standard-size, 20-page, looseleaf bulletin, No. S327, describing the Trane line of unit heaters. Shows photographs of a large number of applications in many types of buildings and gives information on the following unit heaters: the projector Model P, the propeller Model N, the blowers Model T, and multiple projectors Model MP. THE TRANE CO., LA CROSSE, WIS. 25

Welding. A standard-size, 36-page bulletin on the procedure for producing all types of welds in mild steel, for welding all metals used to any extent industrially, and for applying surfacing metal to meet any type of wear-action in service. Also gives information on Lincoln electric welding equipment. THE LINCOLN ELECTRIC CO., CLEVELAND, OHIO. 26

Welding. Two standard-size catalogs covering the entire line of Airco welding and cutting apparatus and supplies. Catalog 22, containing 32 pages, depicts hand welding and cutting torches and tips, pressure regulators, fluxes, rods and other supplies, and information and illustrations of portable oxygen and acetylene manifolds, circular cutting attachments, and like equipment. Catalog 21, 64 pages, is designed to assist the large user of oxy-acetylene equipment and electric arc welding machines. Contains information on acetylene generators, industrial gases, and oxy-acetylene machines. AIR REDUCTION SALES CO., NEW YORK. 27

Brief Reviews

(Concluded from page 43)

COKE. The final statistics of production of by-product and beehive coke in the calendar year 1937. Because final figures on the coke industry for 1937 were delayed, the coke and byproducts chapter in the Minerals Yearbook 1938 shows only preliminary data for 1937. These tables have therefore been assembled in mimeographed form and are being furnished to all coke producers and all others on the Bureau of Mines' mailing list for the annual printed coke reports. These statistics will probably be included in the Minerals Yearbook 1939 together with the corresponding final statistics for 1938. [*"Coke and Byproducts Tables, 1937," No. 6904, by H. L. Bennit and M. van Siclen. Published by the Bureau of Mines, United States Department of the Interior, Washington, D. C. Mimeographed; 8 x 12½ in.; 29 pages.*]

MINERALS YEARBOOK, 1938. The complete Bureau of Mines Official Record of mineral production in the United States in 1937. Also includes information on the world production and movement of mineral commodities. [*"Minerals Yearbook, 1938." Published by the Bureau of Mines, Department of the Interior, Washington, D. C. Cloth bound; 6 x 9½ in.; 1339 pages; price, $2. Obtainable from the Superintendent of Documents, Washington, D. C.*]

TO OBTAIN COPIES OF TRADE LITERATURE listed in this issue, circle on the list below the publications wanted, using the item number at the end of each review; fill in your name and address, mail to

HEATING & VENTILATING
148 Lafayette St., New York, N. Y.

16	17	18	19	20	21
22	23	24	25	26	27

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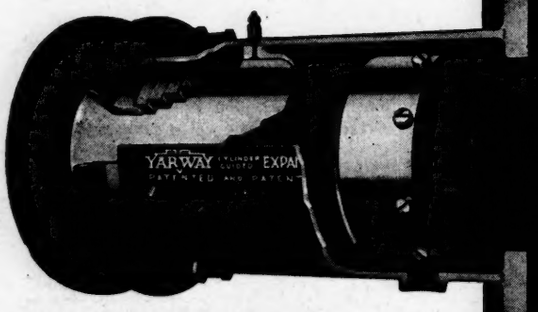
CYLINDER-GUIDED FOR TROUBLE-FREE SERVICE



Made in single or double end types with or without base.

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EXPANSION JOINTS

Welded Steel construction. Alemite lubrication. Diameter no larger than pipe flange... Outside cylinder guide design prevents abrasive sediment from cutting the sleeve. Write for catalog EJ-1904, which describes both Gland-Pakt and revolutionary Gun-Pakt (packed under pressure) types.

YARNALL WARING COMPANY, Philadelphia
104 MERMAID AVENUE

FIBERGLAS*...

an amazing product that may cut costs in your business!

Now being made by a new company—OWENS-CORNING FIBERGLAS CORPORATION—formed by Owens-Illinois and Corning

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HEATING & VENTILATING, *formerly* HEATING & VENTILATING MAGAZINE, published monthly by THE INDUSTRIAL PRESS, 148 Lafayette Street, New York, N. Y. Subscription rates: United States and Canada, $2.00; Foreign, $3.00. Single copies, 30 cents. Vol. 35, No. 12. December, 1938. Entered as second-class matter, April 18, 1925, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

FOR FIREBOX BOILERS *it's*

★ Plunger Feed
★ Side Cleaning
★ Mechanically Driven

DETROIT LoSTOKERS

Fits the furnace

● Many grate area sizes and capacities to fit the furnace with maximum combustion space. No side wall or front wall brickwork required. Stoker front made to suit the boiler base, with ash removal doors. Coal hopper designed to clear boiler doors—with an agitator for continuous feed of coal to the LoStoker plunger. LoStokers are compact with drive and blower built in. Easy to operate, require little power. Also built for horizontal tubular, water tube and cast iron boilers.

Detroit LoStokers produce high efficiency and capacity. Great coal savers.

WRITE FOR BULLETIN No. 373

DETROIT STOKER COMPANY

SALES AND ENGINEERING OFFICES
GENERAL MOTORS BUILDING
DETROIT • MICHIGAN

MAIN OFFICE AND WORKS
MONROE • MICHIGAN
District Offices in Principal Cities

BADGER EXPANSION JOINTS

Maintenance-Free

Handling of Pipe Line Expansions, Contractions and Other Movements

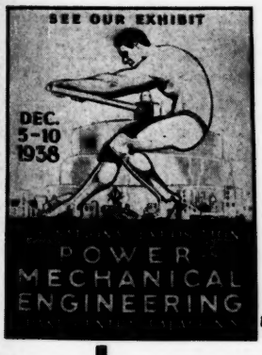
Bulletin 100 Bulletin 200 Bulletin 300

Each of the several designs of the Badger Expansion Joint is of the corrugated type. Requiring no packing of any kind, it requires no servicing throughout its long life. It is as compact as any fitting, thereby saving considerably in space and insulation cost.

As for its utility, the Badger Expansion Joint takes care of a wide range of problems. There are single units for traverses measured in fractions of an inch and single units for traverses up to 6 inches. One design will take care of a certain amount of vibration and lateral distortion. Permissible pressure range is from vacuum to 300 pounds. Temperatures may go to 900°F. Standard expansion joints are made of copper or stainless steel.

Controlled heat treatment is used throughout in order to obtain the fullest benefits from this important phase of metallography.

In sending for further information, give us details of your problems so that we may know which design of expansion joint to recommend.



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STREAMLINE

TRADE MARK REG. U. S. PAT. OFFICE

COPPER PIPE AND FITTINGS *are not expensive*

THE installed cost of STREAMLINE Copper Pipe and Solder Fittings is very little, if any, higher than rustable materials; yet it has outstanding advantages for countless uses in piping jobs where temperature and pressure are not excessive—and as a rule, its first cost is its final one. It cannot rust. Its ultra-smooth interior finish offers no anchorage point for the accumulation of scale or other foreign matter. It is easily installed in the closest quarters. It is a space economizer.

The transmission of heat through Copper Pipe is effected more rapidly and with less heat loss by radiation than through any other piping materials used for the purpose. There are savings in insulating materials too.

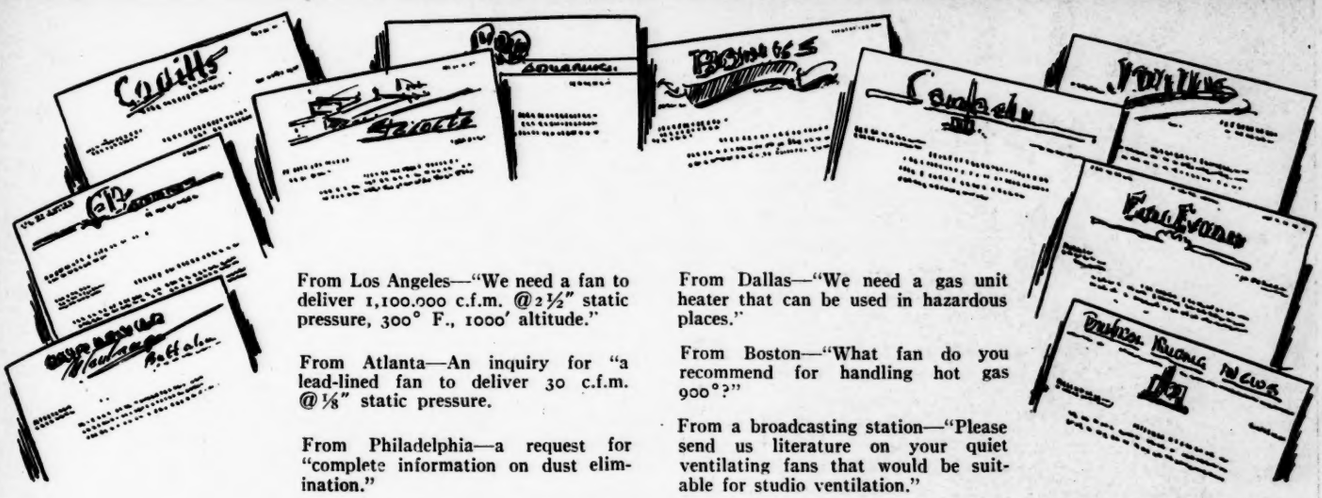
STREAMLINE Copper Pipe and Fittings are the ideal material for concealed convection type heaters, unit heater coils, gas fired type boilers, indirect water heaters, booster heater coils, humidifiers, dehumidifiers, condensers, and the multitude of other uses.

The STREAMLINE Fitting is the original solder type fittings. It is a cast bronze fitting—rigid and strong. The pipe openings are machined to accurate capillary fit for the pipe—and more than that, they stay perfectly round and retain their proper tolerance even when subjected to the intense heat required when the higher melting point solders are used. In short, they make a more positive, workmanlike job, more satisfactory for you to use, and eminently more satisfactory for the finished unit.

STREAMLINE Solder Fittings are manufactured in sizes from 1/4" to 12" inclusive, and in a complete range of reductions in tees and elbows. You connect directly to the smaller or larger pipe lines without the use of adapters with their additional expense, both for material and labor. A BETTER JOB—A LESS EXPENSIVE JOB—AND A MORE WORKMANLIKE JOB.

STREAMLINE
PIPE AND FITTINGS DIVISION
MUELLER BRASS CO.
PORT HURON, MICHIGAN

A Glimpse of our DAILY MAIL Tells the Story of "Buffalo" FAN *Engineering Service!*



From Los Angeles—"We need a fan to deliver 1,100,000 c.f.m. @2½" static pressure, 300° F., 1000' altitude."

From Atlanta—An inquiry for "a lead-lined fan to deliver 30 c.f.m. @⅛" static pressure.

From Philadelphia—a request for "complete information on dust elimination."

From Dallas—"We need a gas unit heater that can be used in hazardous places."

From Boston—"What fan do you recommend for handling hot gas 900°?"

From a broadcasting station—"Please send us literature on your quiet ventilating fans that would be suitable for studio ventilation."

THE inquiries quoted above, taken from our daily mail, truly demonstrate the broad scope of Buffalo Fan Engineering Service.

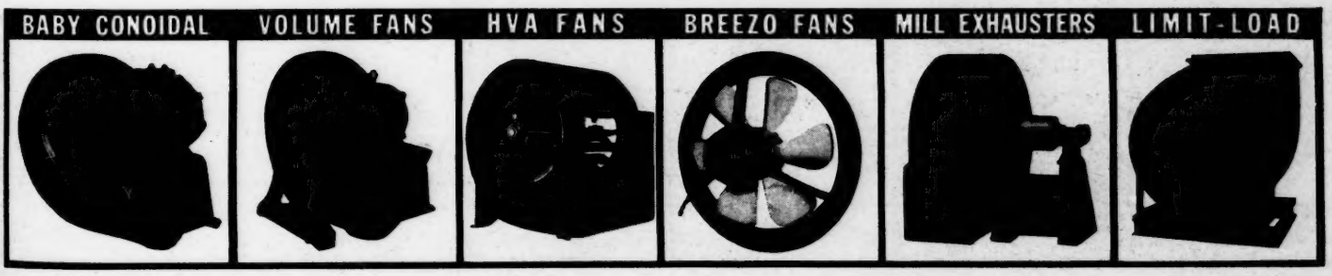
The writers of those inquiries know that they can get the correct fans to solve their air handling problems regardless of size or special design if they bring those problems to Buffalo Forge engineers.

For over 60 years, we have been designing and building fans for industry. In fact, it would be difficult to name an industrial plant of the first rank that is not a Buffalo customer. We invite you to take full advantage of this experience whenever you have an air handling problem, be it the simplest form of ventilation or a complex air handling job.

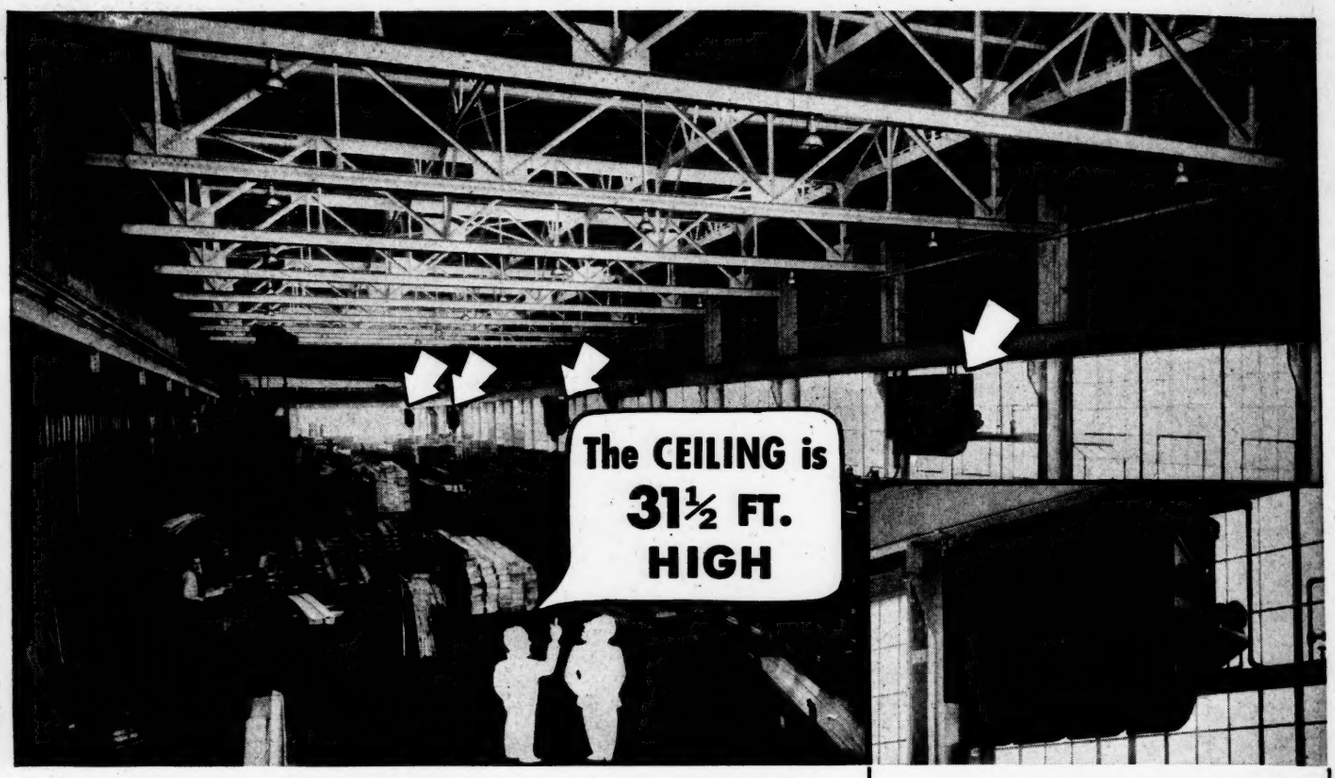
BUFFALO FORGE COMPANY

480 Broadway **Buffalo, N. Y.**

Branch Engineering Offices in Principal Cities In Canada: Canadian Blower & Forge Co, Ltd., Kitchener, Ont.



Prevent Heat Waste
Assure Uniform Warmth—Save Money
with Sturtevant Rexvane Heaters



Stock and shipping room of large Eastern Manufacturer, heated by eight Sturtevant Rexvane Heaters. Total B. T. U.—6,800,000, with 60° entering air; 10 lbs. steam pressure. Total C. F. M.—95,680.

THIS TOUGH HEATING JOB SHOWS HOW IT'S DONE

THIS LARGE AREA is the shipping and stock room of a well-known Eastern Manufacturer. It is 460 ft. long and 60 ft. wide—with a ceiling 31½ ft. high!

Eight Sturtevant Rexvane Heaters take care of the entire heating job. Yet, despite the size of the area and great height of the ceiling, the temperature is kept uniformly warm over the entire space at floor line.

No valuable floor space taken up—all units hung overhead, at the walls.

If you have a heating problem, let us show you, too, how you can prevent heat waste, assure uniform warmth and save money with Sturtevant Rexvane Heaters. Our nearest representative will gladly call or mail Catalog 395-3.

B. F. STURTEVANT COMPANY Hyde Park, BOSTON, MASS.
Sales Offices in 40 Cities B. F. Sturtevant Co. of Canada, Ltd.—Galt, Toronto, Montreal

Rexvane Heater Advantages

1. **Guaranteed for 200 lbs. Pressure**
   And suitable for all steam pressures up to 200 pounds.
2. **Low Final Temperatures**
   Assure comfort for people near heaters.
3. **Guaranteed Capacities**
   In accordance with A.S.H.V.E. requirements.
4. **Wide Range of Sizes**
   Up to 1,421,000 B.T.U. (Standard rating).
5. **Flexibility of Application**
   All sizes available for either floor, wall or ceiling installation—belt or direct drive.
6. **High Efficiency**
   Large air volume handled with comparative quietness—at high efficiency—and extremely low horse-power.
7. **Time-Saving Installation**
   Sectional construction permits reversal of fan, heating, and center units to meet unexpected piping or other conditions on job.
8. **Thermadjust Control**
   Optional; either automatic or manual operation.
9. **Three-Bearing Construction**
   Assures long shaft life. Center bearing easily re-aligned on job by any mechanic.

Sturtevant
REG. U. S. PAT. OFF.
Puts Air to Work

Fans, Blowers, Air Washers, Air Conditioning, Heating, Vacuum Cleaning, Drying, Mechanical Draft Equipment

The Symbol of
Good Air Conditioning!

AUTHORIZED LICENSEE

THE PUBLIC IS BEING TOLD TO LOOK FOR THIS EMBLEM WHEN BUYING AIR CONDITIONING FOR ALL COMFORT APPLICATIONS.

"Leading engineers know the superior features of Auditorium systems - - the Public also knows them.

Contractors authorized to install these desirable systems are identified by the above emblem.

do you know that:-

the big majority of prominent air conditioning installations are Auditorium Systems installed by Auditorium Licensees. If you don't . . . . investigate!

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Send without obligation, full information about Auditorium Systems and the New Auditorium Plan.

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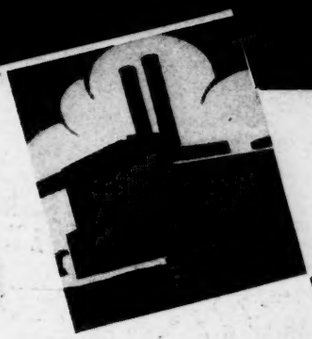
HEATING & VENTILATING

AIR CONDITIONING



THE INDUSTRIAL PRESS
PUBLISHERS
140-148 LAFAYETTE STREET
NEW YORK

December, 1938

To the Readers of HEATING & VENTILATING—

The next issue of HEATING & VENTILATING will be as practical as your handbook. It's the Yearbook of Progress, a digest of 1938 contributions to air-conditioning, heating and ventilating theory and practice—with new developments, new applications, new appliances, vital statistics, market data, a well illustrated authoritative guide for engineers and contractors. You'll refer to it again and again throughout all of 1939!

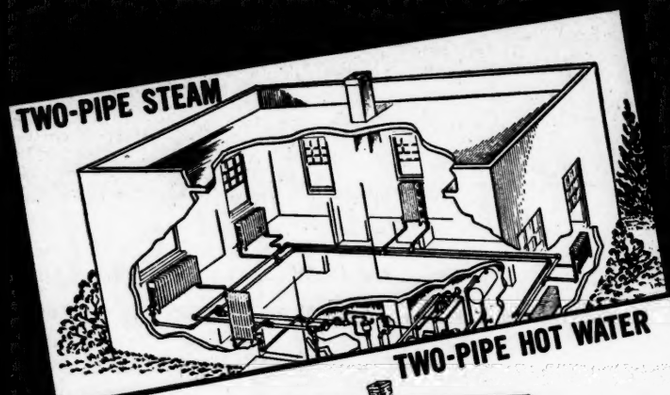
For simplicity and emphasis, the editorial contents and related advertisements will be divided into these four sections: (1) Summer Cooling and Dehumidifying, (2) Winter Heating and Humidifying, (3) Year 'round Ventilating and Air Cleaning, (4) All-season Essentials. This arrangement has been a Yearbook feature, and will continue to be so. Because quick reference is an easy matter, especially as the Yearbook will probably be in service for 365 days to come. Because these four sections closely tie-up an advertised product and service with the editorial data pertaining to that product... a time-saving feature for the reader... a sales-boosting feature for the manufacturer.

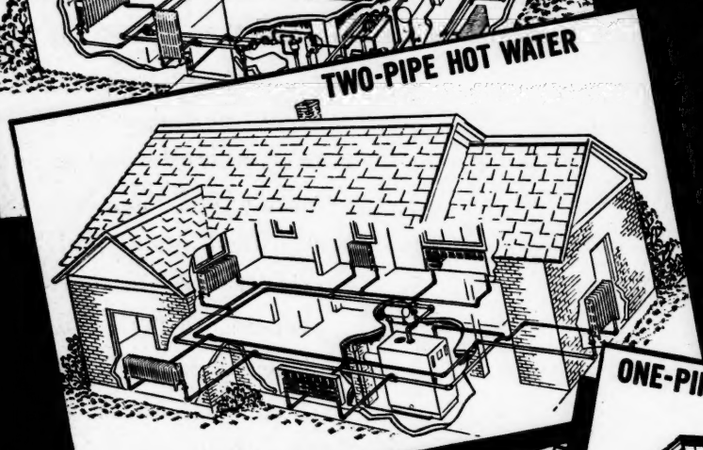
Very truly yours,

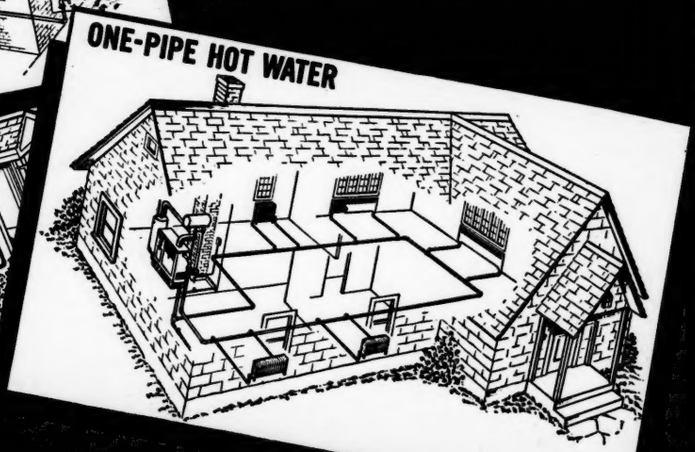
C. B. Hotchkiss

HEATING & VENTILATING.

REGARDLESS OF THE SYSTEM
REGARDLESS OF THE FUEL
CRANE HEATING *covers them all!*







STEAM, hot water, or vapor . . . one pipe or two . . . coal, oil or gas . . . no matter what the system or fuel requirements may be, the Crane Heating Line covers them all.

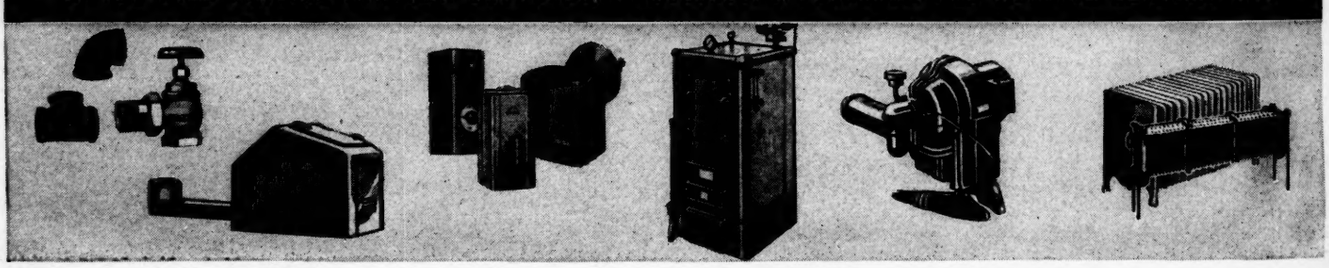
The advantages of Crane Complete Heating are many. A single responsibility stands back of the entire system, because Crane supplies every need of heating equipment: boilers designed for any fuel, oil burners, stokers, radiators, convectors, controls, piping, valves and fittings. Both you and your clients enjoy important benefits that result from the one high standard of quality in every part, and the fact that the whole system is designed to function as a unit. Added to this is the satisfaction in engineering performance that the name Crane brings.

CRANE

VALVES · FITTINGS · PIPE · PLUMBING · HEATING · PUMPS

CRANE CO. GENERAL OFFICES 836 SOUTH MICHIGAN AVENUE, CHICAGO

NATION-WIDE SERVICE THROUGH BRANCHES, WHOLESALERS, PLUMBING AND HEATING CONTRACTORS



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FOR ENGINEERS AND CONTRACTORS CONTROLLING THE DESIGN, SPECIFICATION, INSTALLATION AND MAINTENANCE OF HEATING, VENTILATING AND AIR CONDITIONING.

HEATING & VENTILATING
AIR CONDITIONING

FOR DECEMBER, 1938

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NEXT MONTH:

As 1938 draws to a close the staff of HEATING & VENTILATING is hard at work reviewing the accomplishments of the industry for the past twelve months and in collecting, tabulating and analyzing the numerous statistical data which reflect the activities of the various component branches of the heating and air conditioning business. Your next issue, which will contain the results of all this effort, will be the Sixth Annual Yearbook of Progress. As usual, it will include sections on Winter Heating and Conditioning, Summer Air Conditioning, Year-Round Functions, and Controls and Instruments; these sections will consist of a review of the year's activities in that field, description of 1938 New Equipment, and complete statistical data. A feature will be a forecast of 1939 new building by a nationally-known economist.

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HEATING & VENTILATING is published monthly by The Industrial Press, Robert B. Luchars, President; Edgar A. Becker, Vice-President and Treasurer; Erik Oberg, Secretary. Published at 148 Lafayette Street, New York, N. Y. Western Office, 228 North La Salle Street, Chicago, Ill. Yearly subscription in United States, Spain, South America, Mexico, and Canada, $2.00; in all other countries, $3.00. Single copies, 30 cents. Member of Audit Bureau of Circulation and Associated Business Papers.

VOLUME 35 NUMBER 12

EDITORIAL STAFF

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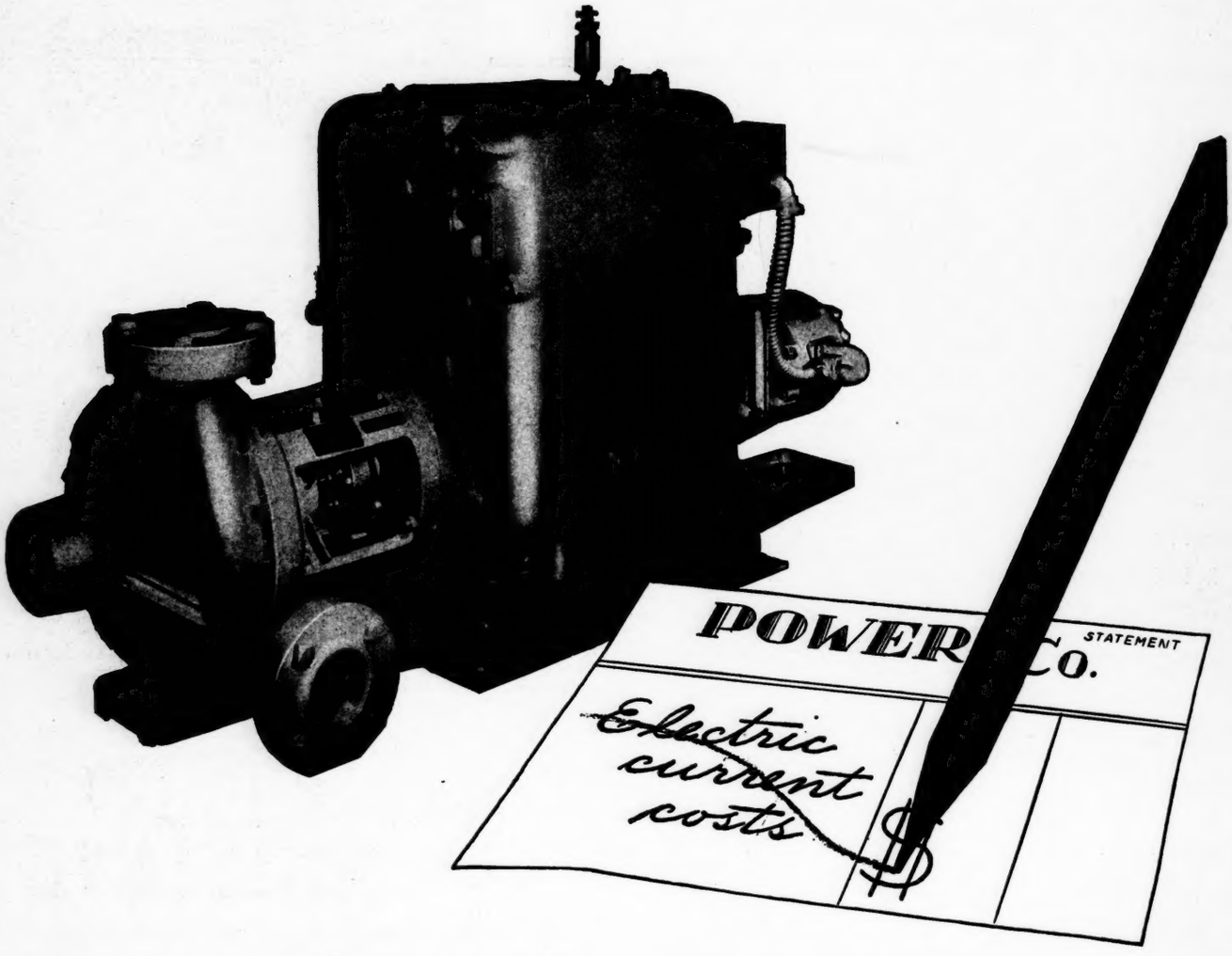
C. H. B. HOTCHKISS
Associate Editor
CLIFFORD STROCK
Assistant Editor
JOSEPH F. KERN, JR.

A NASH VAPOR TURBINE HEATING PUMP WILL ELIMINATE THIS EXPENSE ITEM.



The Jennings Vapor Turbine Return Line Vacuum Heating Pump requires no electric current, eliminating the one biggest expense item in the operation of an ordinary return line pump. This is because the motive power is a special turbine operating on steam direct from the heating system. Steam used to drive the turbine is returned to the system for heating, with little heat loss.

The really important saving promoted by the Jennings Vapor Turbine is in the system itself, however, for this is the only heating pump that can operate continuously with economy. Continuous operation means uniform circulation, and uniform circulation means a big saving in steam.

This pump has but one moving part, no internal wearing parts, and no internal lubrication. It is compact and quiet, and will give long and satisfactory service at the lowest maintenance cost. Bulletin No. 246 tells all about it. It is free on request.

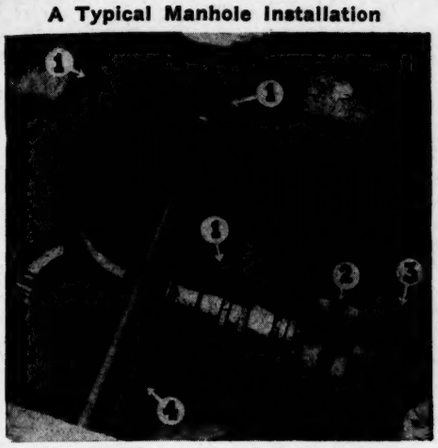
THE NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.

ADSCO INTERNALLY GUIDED JOINT

A COMPACT, EASILY INSTALLED JOINT FOR HIGH OR LOW PRESSURES

A Typical Manhole Installation



(1) ADSCO Internally Guided Joints in manhole under construction (2) ADSCO Insulation Support (3) ADSCO Pipe Alignment Guide and (4) ADSCO Empire Steam Trap.

Can be specified with Confidence for years of Efficient Operation —Hundreds in Daily Use.

An internal guide on the inner end of the slip provides true axial movement throughout entire slip traverse. No metal to metal contact between polished slip surface and body. Slip cannot pull out of the joint. A compact joint for restricted space — largest diameter is the flange.

Available in single or double joints in semi-steel or cast steel for high pressures and high temperatures with flanged or beveled ends.

Write for Bulletin No. 35-30PR.

Sectional View of Joint

A Few Users

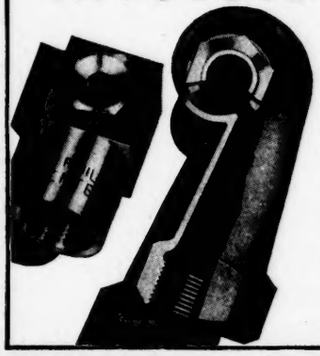
Cons. Gas. Elec. Lt. & Pr. Co. Baltimore, Md.
Philadelphia Electric Co. Philadelphia, Pa.
Atlanta University Atlanta, Ga.
Moose Lake State Hospital Moose Lake, Minn.
Olds Motor Works Lansing, Mich.
Union Pacific R. R. Co. Council Bluffs, Ia.
U. S. Navy Yard Brooklyn, N. Y.
Wards Island Sewage Works Wards Island, N. Y.

AMERICAN DISTRICT STEAM COMPANY

NORTH TONAWANDA, N.Y.

IN BUSINESS OVER SIXTY YEARS

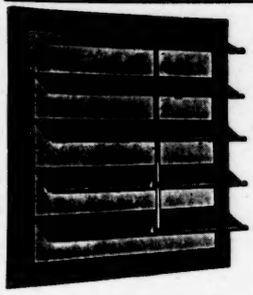
YARWAY INVOLUTE NOZZLES



The preference for trouble-free air washing service — because there are no internal parts or vanes to wear or clog. Proven through many years of service in water cooling and air conditioning installations totaling more than 5 million g. p. m.

Made in sizes and types for all requirements. Ask for Bulletin N-615.

YARNALL-WARING CO., PHILA.
104 MERMAID AVENUE



ELGO TYPE

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Miller Mallets are offered in 8, 16, 24, and 40 oz. sizes. Ask your local jobber for prices or write—

THE MILLER RUBBER COMPANY, INC.
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Engineers in Rubber

..AND BESIDES ALL THAT, IT COMES IN 784 SIZES!

"NOW you're saying something!" is the usual pleased comment when we give out the news that Nesbitt Series H Heating Surface is available in seven distinct surface types, each of which is subdivided into eight fin widths and up to sixteen fin lengths, *a total of 784 available sizes!* Thus, besides its engineering efficiency—"delivering the goods" in all applications up to 200 pounds gauge, from low-pressure heating and ventilating to high-temperature and high-pressure heating or drying, Series H Surface is adaptable to the most varied size requirements. Made entirely of copper and copper alloy it stands up under the corrosive effects of even high-pressure steam. Why not utilize this EXTRA efficiency in your next installation? John J. Nesbitt, Inc., Holmesburg, Phila., Pa.

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NESBITT
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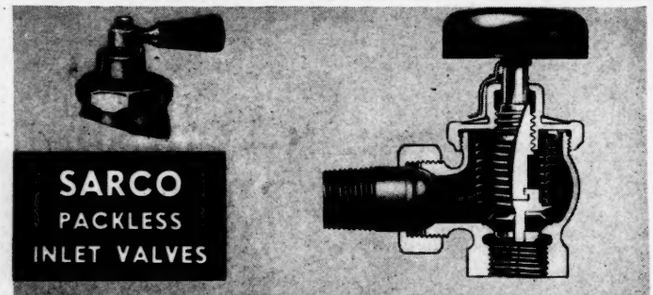

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FOR PERMANENCE WITH PROFIT
Make Your Heating Systems **SARCO** *Throughout*

Sarco inlet valves are of the truly packless type. The stems are sealed with a bellows made from the same seamless, corrugated bronze tubing which has made Sarco radiator traps so successful. No packing of any kind is used, and there is thus no danger of leakage.

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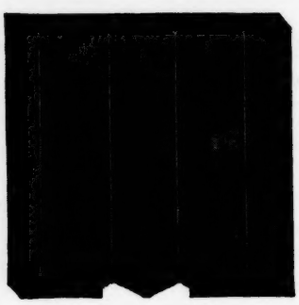

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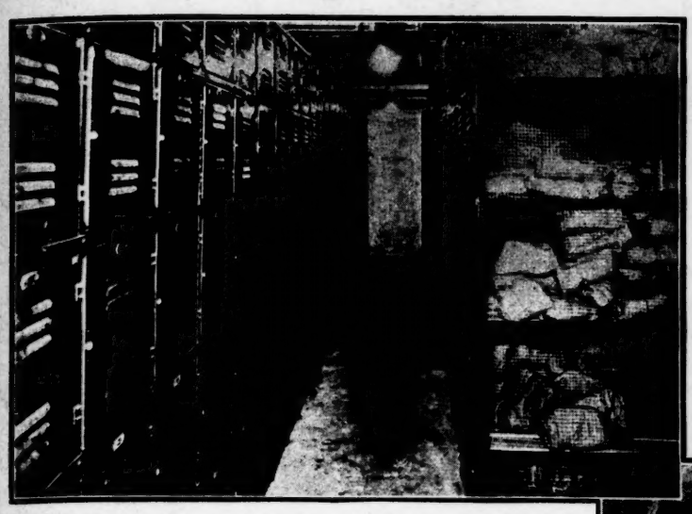

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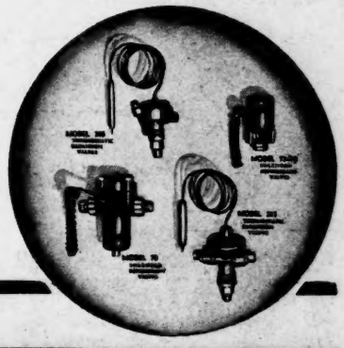

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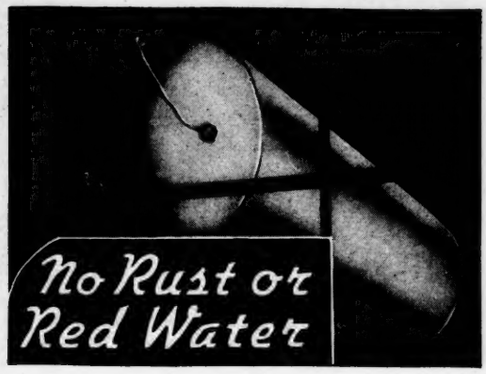
THE BYWORD FOR A-P VALVES



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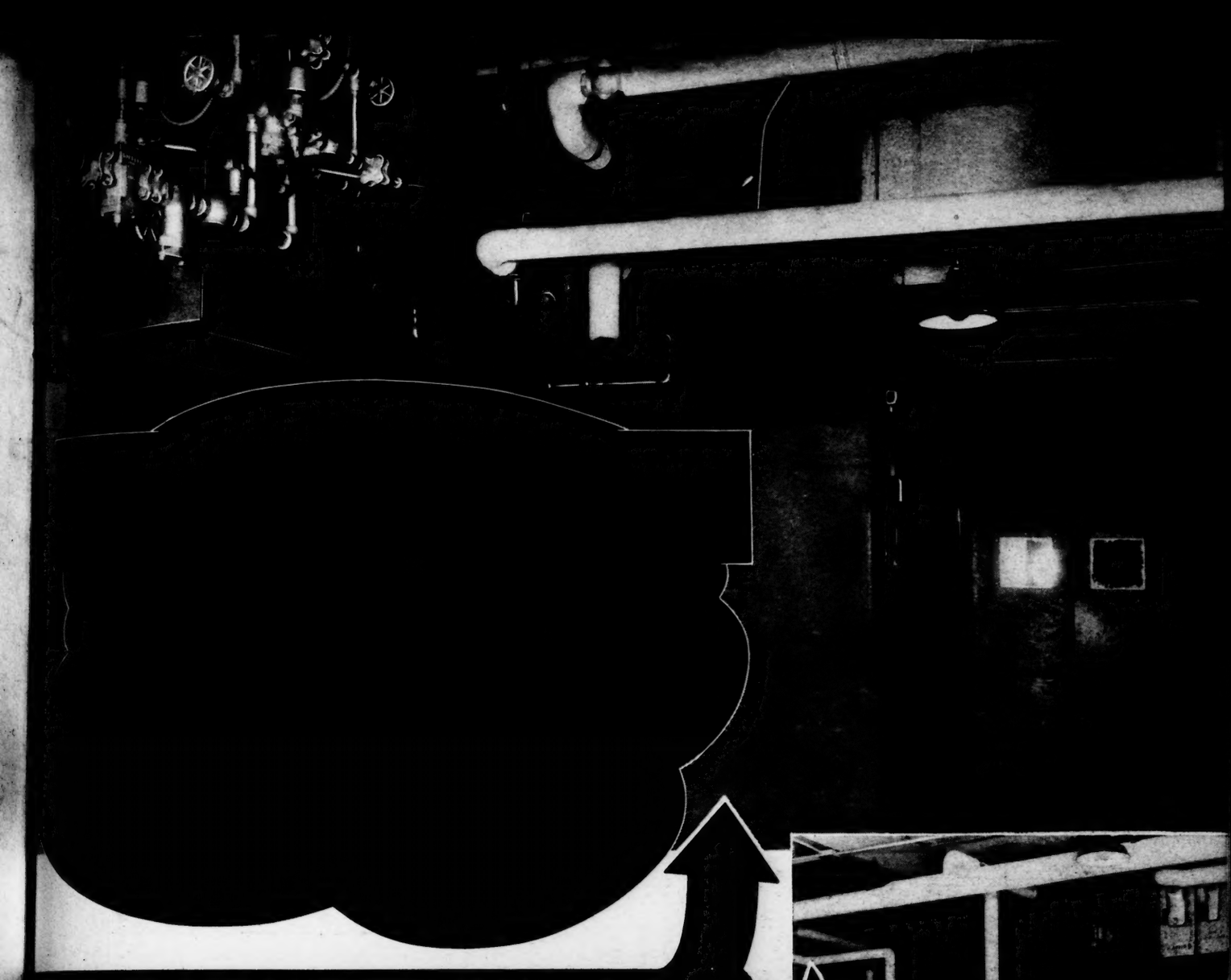
to secure good men of the heating, ventilating and air conditioning field. Rate, $2 for first seven lines.



Ideal for Stores, Restaurants, Offices and Industrial Depts.–Suspended and Floor Units

ASIDE from dependability and low-cost operation, one of the biggest features of this Clarage equipment is **FLEXIBILITY.**

Multitherm Units are manufactured in a wide range of combinations and sizes—in both horizontal and vertical types. Undoubtedly the most complete line of conditioning units on the market today.

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Address .....

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where dust, fumes, stale air abound

This Sturtevant fan carries off all fumes from pickling operation—eliminating fog and enabling the operator to do better, faster work.

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